SCIENCE LIBRARY

JUL 23 1923

ENGINEERING & MINING JOURNAL-PRESS

A CONSOLIDATION OF ENGINEERING AND MINING JOURNAL AND MINING AND SCIENTIFIC PRESS

McGRAW-HILL CO., INC.

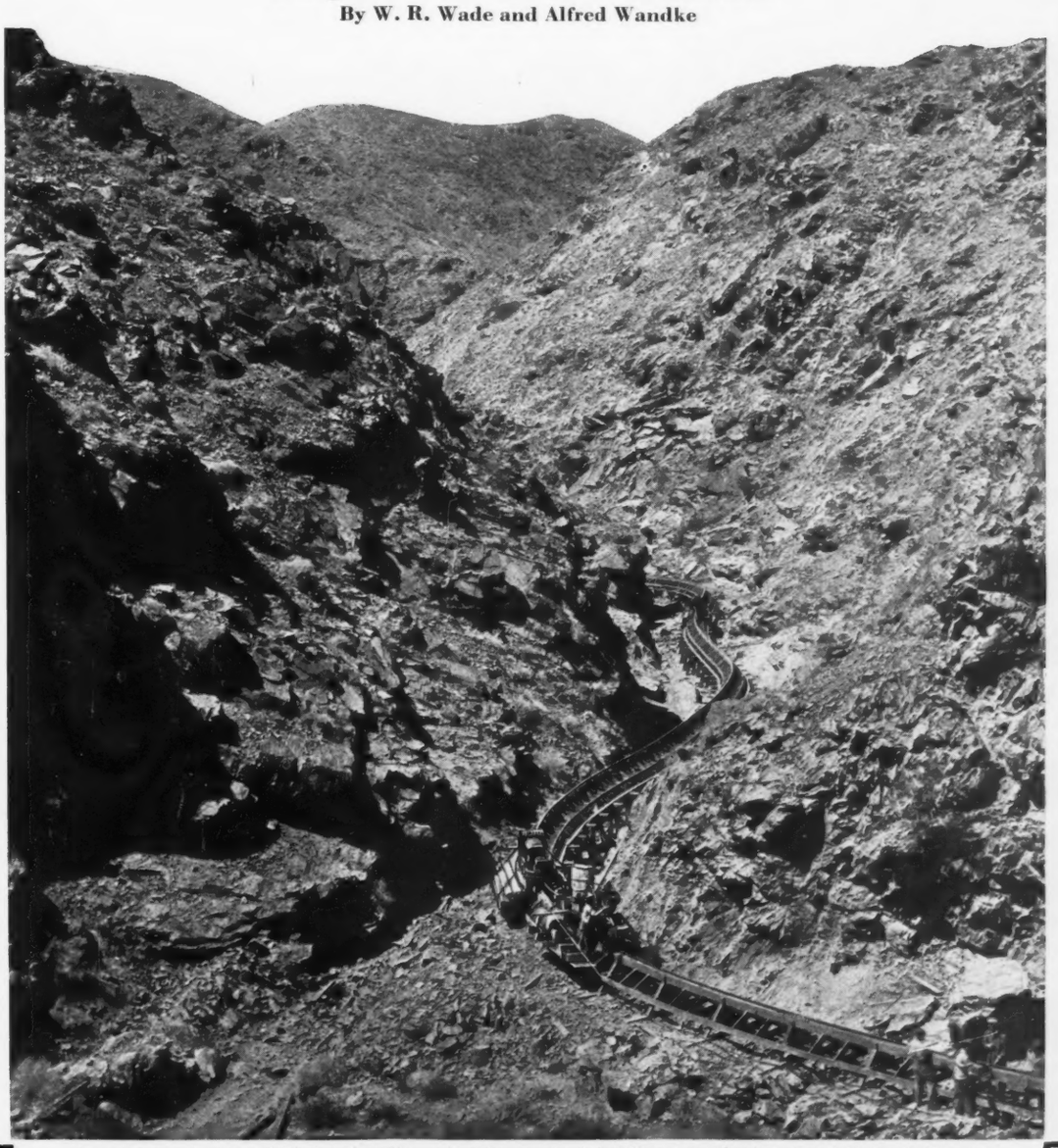
PRICE 25 CENTS

Mining Under Fire Conditions

By W. G. Scott and S. A. Mewhirter

A Big Zinc Mine in New York State

By W. R. Wade and Alfred Wandke



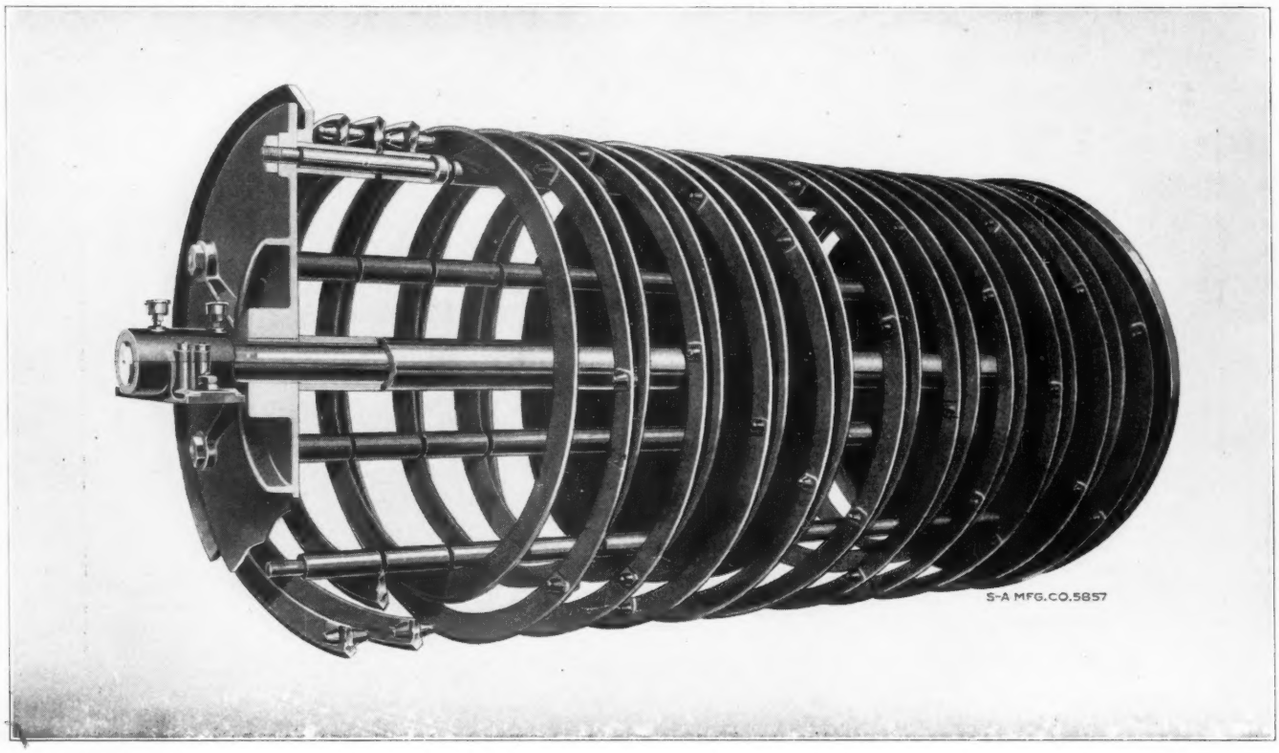
Monorail 28 miles long which American Magnesium Corporation is building to its deposits in Death Valley, California

A WEEKLY JOURNAL REPRESENTING THE WORLD'S MINING AND METAL INDUSTRIES

July 21, 1923

BURCH Grizzly

A new non-clogging grizzly—

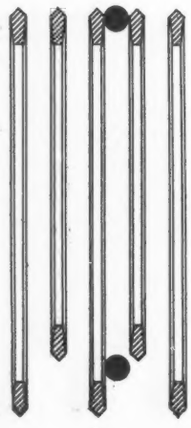


PATENTED

A Ring Type Grizzly That Will Not Clog

The over-size is carried over on top the rings. The fines pass thru.

Uniform spacing of the rings for accurate separation and increased openings for easy passage of fines.



Where fines are to be separated from the product that goes to the crusher, the Burch Grizzly is right in its element. The Grizzly will carry over the lumps to the crusher and allow the fines to be by-passed.

This Grizzly was invented by H. Kenyon Burch, prominent Mining Engineer.

Built in three standard diameters, 36, 48 and 60 inches and in any width up to 10 feet. The ring spacing can be constructed to suit the requirements.

STEPHENS-ADAMSON MFG. CO., AURORA, ILLINOIS

ENGINEERING & MINING
JOURNAL-PRESS
JOSIAH EDWARD SPURR, Editor

Volume 116 | **New York, July 21, 1923** | *Number* 3

Metal Prices To Be Broadcast

THOUSANDS OF OUR READERS scattered through the mining districts of the West have a more direct interest in our metal report than in any other feature of the *Journal-Press*, for the state of their pocketbooks depends on the prices received for their products, which are, in turn, calculated from the figures which we publish. It is important that our quotations be in the hands of those who use them as soon as possible. Two or three years ago we tried the experiment of telegraphing our market report to our San Francisco office, where it was set in type and mailed by first-class mail to our western subscribers. The results secured by this procedure were not commensurate with the expense entailed, for the time saved was slight on the average.

Now we turn to what we believe will be a more satisfactory method of serving the industry. Every Wednesday afternoon between 4 and 5 o'clock, New York time, we shall telegraph a full report of the prices of copper, lead, and zinc, with a brief comment on the market, to the *Fort Worth Star-Telegram*, through whose kind co-operation it will be broadcast from the radio station WBAP the same evening. We expect to start this service on Aug. 1. WBAP is well known to radio enthusiasts of the Southwest, and we believe the broadcasting from that station can be heard in most of the districts that will be interested. It has the reputation of sending out good live programs.

May we ask that those of our readers who find this service useful advise us of the fact and also a note of appreciation to the *Fort Worth Star-Telegram* would not be out of the way. Needless to say, neither ourselves nor the *Star-Telegram* get any direct return for the service; on the other hand, we must pay for the telegrams and our Fort Worth collaborators will pay for the broadcasting. We shall be glad to hear of any improvements our clientele feel it desirable to have made, to the end that our report be of the greatest use to the largest possible number of listeners.

Mining the Pegmatites

ESPECIALLY in the eastern part of the United States, pegmatite dikes are being increasingly mined, not only for the rarer minerals which they contain, but also for their standard component minerals—mica, feldspar, and quartz. The pegmatite was formerly often called "giant granite," for though it was composed of the same minerals as granite, the size of the individual crystals in the pegmatite fabric is usually vastly larger than in the granite, and from a quite usual size of several inches the size of individual crystals increases in some cases up to several feet.

It is indicated that the pegmatite magma differs from the granite magma in containing a larger proportion of gaseous material, largely water; and through the aid of this mobile composition the freedom of molecular movement in the pegmatite magma has been greatly increased, so that great crystals could be built. The same circumstance has allowed the collection together of the different minerals into irregular masses and bunches, so that in some pegmatite dikes parts are mainly feldspar, parts mainly quartz, and parts mainly mica. Such richer parts are frequently mined for feldspar, or for mica, as the case may be, or even for quartz; and thus the simplest type of a magmatic ore deposit or veindike originates. These segregations bid fair to become increasingly important as commercial sources for the minerals in question.

The local laws of such segregations are difficult to work out, if indeed possible. The different parts of the pegmatite fabric have not crystallized simultaneously, but at leisure and with a definite sequence of stages; and this magmatic sequence of crystallization, of scientific interest only in the granite, becomes of commercial importance in the pegmatites which are mined for their component minerals. Closer study in individual cases may yield results of aid in prospecting and mining. Further improvements in milling, and thereby making cleaner separations of the feldspar and mica and quartz where these are to some extent mingled, may also permit mining less selectively in the future; and through these separate advances, of geologic interpretation and of beneficiation, the mining of pegmatites may be increasingly encouraged.

North Butte and Anaconda

THE North Butte Mining Co., having approximately 200,000 tons of developed ore averaging 4.1 per cent copper and 3.2 oz. silver per ton, and equipped with one of the best mining plants in the country, has suspended operations because it cannot make money under prevailing conditions. During recent months the company has been producing about 1,400,000 lb. of copper and 55,000 oz. of silver monthly. North Butte has a comparatively favorable contract with the Anaconda Copper company for concentrating its ore and smelting the concentrate. Being situated literally in the midst of Anaconda mines, the haul to the Washoe Reduction Works was no longer than required for Anaconda's own ore.

Under the able direction of Norman B. Braley, general manager, mine operations had been organized systematically, and a novel system has been established of paying miners on the basis of a bonus, over and above day's pay, measured by work accomplished in excess of predetermined standards. So successful had this been that the efficiency of the underground men, both individually and collectively, was unusually high and the labor cost of production was probably lower than that of any similarly circumstanced mine in Butte. Nevertheless, the directors admit that with copper at 15c. and silver at 63c. they cannot make ends meet.

They say that they could operate profitably on 18c. copper. Just how much below 18c. the dividing line between profit and loss is, must be conjectured; 18c. is used as a "safe" figure, so that the actual is probably a cent or two lower.

The completion of the Pittman Act silver purchases is one factor, but by no means the only one, that caused the shutdown. The decline in the copper market; the prevailing high basic wage scales; the high current prices for mining supplies; the unavoidable increase in the cost of mining on the 3,400 and 3,600 levels, compared with those above; and the narrowing of the orebodies in the deeper workings—all have contributed to the present situation.

The company's annual report for 1922 gave the total operating cost including taxes as 18.54c. per lb., which was reduced to 15.22c. by crediting 3.32c. for the silver and gold—the last being inconsiderable. If silver had sold for 65c., that credit would have been around 2.2c. and the net cost would have been 16.34c. It seems reasonable to assume that this is not far from the cost that prevailed during the month of June just passed when silver was 65c.

The question at once asserts itself "What about Anaconda?" Anaconda's policy is to conceal data regarding the grade of ore mined and of that remaining in its mines, and to mask cost figures in its published reports, so that the public cannot interpret them. Accordingly, any attempt to analyze the situation is largely speculative; nevertheless, it is fascinating speculation. First, wherein has Anaconda an advantage over North Butte? Having fifteen copper mines, it is able to exercise more selection in mining and can doubtless maintain its ore shipments at a higher average grade. Through some of its shafts it can mine from wider veins and at much less depth than can North Butte. A second source of economy is the probable smaller overhead charge per ton of ore, arising from the centralization of administration for a large, compact group of mines producing 18,000,000 lb. of copper per month. A third consideration is the fact that as owner of the railroad and the reduction works the Anaconda company charges its own mining department less than it did North Butte for hauling and treating the ore.

On the other hand, Anaconda's labor policy has been to let the law of supply and demand take its course freely. When labor has been plentiful the company has paid low wages and demanded a big day's work from the men. When labor has been scarce (as it is today) it has paid high wages and accepted a minimum day's work from the miners. The contract system has been in vogue of late years, and it is doubtful if the results, as measured by work done per dollar of payroll, will compare with those obtained by North Butte, with its standard-and-bonus system. And labor of course is a very important element in cost. Anaconda, thanks to its ownership of the American Brass Co., enjoys marketing facilities that North Butte does not have; but a pound of copper from an Anaconda mine is no more valuable to the American Brass Co. than a pound from Michigan, Africa, or Peru. By the same token, Anaconda's copper is worth no more than the price of copper in the open market, which as this is written is about 14.50c. at an Atlantic seaboard refinery.

If it cost North Butte 16.34c. per pound to make copper in June, it would be interesting to know what profit—if any—Anaconda is making on its current copper-mining operations at Butte.

The Reno Silver Conference

EVERY MINING COMPANY that produces an important quantity of silver in the western hemisphere owes it to its stockholders to have a representative at Reno, Nev., next month. The Senate Commission of Gold and Silver Inquiry will meet there on Aug. 15 to consider the problems of the silver-mining industry. Invitations have been issued to every producer in Canada, Mexico, Central America, and South America, as well as in the United States, to attend the meetings. Already definite assurance has been received by Senators Pittman and Oddie that representatives of the most important producers in this country will be present. They will be prepared with constructive plans for putting the distribution of silver in the markets of the world on a better basis. A Silver Export Association will be discussed thoroughly, and if actual organization is not effected, plans for future action will be developed. The Senators for Nevada are confident that they can obtain necessary legislation to iron out any possible legal obstacles. The belief is crystallizing in all quarters that the financing of such an organization is practicable; and that an association will be effective in preventing the forcing of metal on the market when demand is negligible, in minimizing the profits of middlemen, and in stimulating the use of and demand for silver. What is needed is concerted action and co-operation on the part of mining companies in the Americas. They produce 85 per cent of the world's silver. They cannot afford to miss the Reno meeting.

The Coal Report

THERE IS NO TIME like July for bringing out a report on conditions in the coal industry. Now the public can view the matter coldly and judicially. It is like a change of venue. Those that suffered last winter from coal shortage or from the fear of it have probably forgotten their woes. This is well, for otherwise the tolerance and moderation of the report might be displeasing to some. The execution of no operator is recommended, and the miner may also continue to live. It is hardly enough, however, to make the consumer satisfied with high prices, were that humanly possible. The advance in price, says the report, "is in line with the general advance in commodity prices," but the criticism is made that where prices of other commodities have fallen, that of coal stays up. Profits of producers and dealers as set forth in the report do not seem exorbitant. As to the wages of miners, the income of a family of five ranges from $1,500 to $2,000 on an average, where the mine works the year around—a wage in no way unreasonable. The commission's word may be taken, for owing to the character of its personnel a more unbiased body would probably be difficult to find.

But coal is a public utility, the commission believes—thus officially recognizing what the consumer has long resentfully felt. The industry is affected with a public interest, it says. It recommends governmental regulation and full power for the President to take over the mines and the distribution of the coal to the consumer in national emergency when there are strikes or if there is suspension of operations. "The commission does not recommend the abolition of existing property rights," says the report, "however much might be said for the view that mineral deposits should have been

held from the beginning as national rather than individual property. The commission does not recommend government ownership. . . . It does, however, hold the view that a limited natural monopoly like anthracite, held by a relatively small number of individuals, estates and companies, and supplying a necessity of life for millions of our people, cannot continue to be treated as if it were not affected by a public interest."

The commission can only recommend. It is up to Congress to act. Politics, of course, will have a part in shaping that action, and it is not safe to predict results. It is high time, however, that the public interest in the coal industry were considered, in peace as well as in war.

Continuous Grinding in the Ceramic Industries

IT WOULD APPEAR that continuous-operation wet-grinding equipment, developed to a high degree of efficiency in the hydro-metallurgical industries, will eventually be utilized on an extensive scale for the pulverizing of flint and other materials used in the manufacture of pottery and refractory ware. The ceramic industry has not been alone in its slowness to discard batch grinding, but the advantages of modern and continuous methods are too obvious to be disregarded. In one plant of recent design the crushed flint is fed into a tube mill, operating wet and using pebbles as grinding media; the discharge goes to a Dorr classifier, the oversize being returned to the mill and the undersize passing to a pulp tank which also acts as a classifier. The finest material is dewatered in a Dorr thickener, the underflow from which is available as required.

Doubtless many opportunities will be seen in other industries for the adoption of so simple and effective an arrangement. For instance, it is probable that continuous grinding will find application in the preparation of the fluxed glaze used in the enameling of iron. Crushing and grinding practice has marked a high degree of efficiency in the preparation of ore for metallurgical treatment, and a closer co-ordination of technical industries should result in the interchange of many valuable ideas, in the cheapening of the cost of production and the bettering of the product. Varied and extensive opportunity exists for the adoption of continuous grinding equipment outside the metallurgical industries.

Reopening Old Mines

AT A RECENT MEETING of mining men in Grass Valley, Calif., John Fulton, who has been in charge of the reopening of the Idaho Maryland mine, stated that a thorough investigation of all of the statements made by local mining men and miners who had been employed in the Idaho Maryland when it had been shut down, relative to ore occurrences in the Idaho Maryland, had proved their statements, with the exception of one, to have been without foundation. According to Mr. Fulton, the old miners had closely followed the ore and had practically exhausted the possibilities of the mine in so far as they pertained to the vein originally worked.

This is an important conclusion and is worth the attention of mining men generally. An old mine filled with water is an attractive subject for gossip, and the older such a mine becomes the richer it becomes in the minds of the local people. Mines are shut down chiefly because they are exhausted or because they cannot be made to pay. Small bodies of low-grade ore cannot be profitably exploited; large bodies of low-grade ore can sometimes be made to pay if sufficient capital can be enlisted for an adequate equipment.

However, the abandoned mine is not always a negligible prospect, for although it may be true that the original miners were adepts in following and exhausting the contents of their vein, they were not always as keen in trying out the possibilities of parallel veins or promising structures in the contiguous ground. Frequently, they neglected to run crosscuts or to try for other ore horizons than the one in which they were working. It is on this account that the worked-out mining property is worth some consideration.

In the particular case which we have quoted, prospecting in the footwall country of the Idaho Maryland has resulted in encouraging discoveries. Thus the worked-out mine is a problem for the mining geologist. If it can be first proved from the records of the mine that exploration of ground contiguous to the vein that was worked had not been done, and that a special study of the structural conditions indicates possibilities of the parallel fissures, sufficient justification exists for additional exploration work. In some instances the old miners stopped at faults and dikes, and through failure to properly interpret such discontinuances ceased further operations after working out the available ore. Such a situation would also justify further exploration.

The search for profitable mines is keen, and experienced mining men cannot afford to neglect entirely the worked-out property. It is in just such situations, we venture to predict, that important producers will be found. However, the most thorough investigation is necessary as a preliminary. Well-trained and experienced mining geologists are essential and can find in this situation ample scope for their abilities.

More Work Needed

ONE OF THE OFFICIALS of the Zinc Corporation, in England, said the other day that English zinc mines cannot compete with American companies, because English labor assumes a too leisurely attitude while on duty, according to a despatch to the *Wall Street Journal*. "America can cut us to pieces and will continue until English labor understands that high wages can only be paid where high output is obtained, and drops a 'go slow' policy."

This attitude of labor is not unknown in this country, but according to F. A. Govett, who is reported to have made the above remark, it seems to be even more in evidence in England. We are distinctly in sympathy with a fair workday—say an eight-hour day and a forty-four hour week—and also see no reason why employees should not receive as high a wage as they, without resorting to unfair practices, can persuade their employers to pay; but we feel that in return for high wages and congenial hours the worker must give the best that is in him. He should not limit his output or allow it to be limited by union or other rules. Pay a bonus to the more efficient, or at least for the sake of human progress do not hold down the output to the standard of the poorest worker in the group. During the World War a large amount of material was destroyed. To get back to normal conditions every one must work and produce to the best of his ability.

DISCUSSION

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

Centrifugal Force in Metallurgy

THE EDITOR:

Sir—In an editorial appearing in your issue of June 9, entitled "Centrifugal Force in Ore Dressing and Metallurgy," you mention an idea of the late David H. Browne for cleaning slag by centrifugal action, and state that this scheme was never tried practically because of the apprehended troubles of this "slag whizzer." It would seem that the only way to clean slag of the suspended particles of matte or metal lies in avoiding mechanical arrangements and in inducing a circulation resulting in centrifugal action by means of the electric current. Slag when molten and fluid is a fair conductor of electricity, its conductivity being of the order of that of a strong sulphuric acid solution. Accordingly, it should not be hard to induce an effect similar to that of the induction motor in the slag by the use of a rotary magnetic field with the slag whizzing around at any desired rate.

Indeed, in the ordinary "slag-resistance" furnace electro-mechanical forces are generated which result in a swirling outward of the slag from a circle outside the electrodes to the sides and then down the side to the bottom and upward to the circle. It always seemed to me that this was a modified "pinch effect." Some years ago we treated in an experimental plant in this city over 100 tons of complex zinc ore and at times obtained unusually low percentages of lead and copper in the slags produced. In fact, we made them without attempting to do so, for our aim was to keep the furnace open and to make a zinc vapor that was condensable. Figures of 0.01 per cent Pb and 0.05 per cent Cu soon became so common as to excite little comment in our force. This efficient lowering of values in the slag occurred when the furnace was working smoothly, without agitation of the supernatant charge, and with high reduction which was evidenced by the slags going not over 4.5 per cent Zn. It should be stated that we had a much more intense reducing atmosphere than has the lead or copper blast furnace, for the furnace was reducing some 700 lb. of zinc oxide per ton of charge. It is metallurgically inconceivable that a trace of any lead or copper compound could remain unreduced when such a hard element to reduce as zinc was being reduced in such proportion and to such a degree.

It may then be concluded that the times when we had slags below 4.5 per cent Zn and higher in lead and copper than the extremely low figures mentioned above, were occasions when there was agitation of the furnace and its contents. Our furnace records and my recollection corroborate this deduction. It would therefore seem conclusive that with high reduction and a relatively quiet furnace the circulation of the slag exerted some action having a causative connection with the settling of the matte and metal. Another causal factor is the effect of the sixty alternations of the current per second. This made a humming in the furnace and in the slag and we always thought that the action was like that of the assayer who taps his crucible on the floor to make a good settling action.

Considering all the different factors, it is not remarkable that we attained clean slags when these factors were all in play at the same time. The following figures in skeleton form show that an almost perfect elimination was produced:

Run 25-1: Time, 5 days 8¼ hours; slag, 12 taps, weight, 2,486 lb., analysis, 4.08 per cent Zn, 0.05 per cent Cu, 0.20 per cent Pb; matte, 4 taps, weight 140 lb., analysis, 4.40 per cent Cu, 6.5 per cent Pb; charge 7,317 lb. analyzing 0.45 per cent Cu; the copper-bearing ore analyzing 0.64 per cent Cu; zinc, 9 taps, weight in slabs, 1,445 lb.

Run 24-2: Time, 11 days 2 hours; slag, 24 taps, weight 5,834 lb.; analysis, 3.16 per cent Zn, no Pb, 0.01 per cent Cu; ore, 9.188 lb., 2.25 per cent Cu and about 0.10 per cent Pb; matte, 2 taps, weight 848 lb., 9.67 per cent Cu; zinc, 12 taps, weight in slabs, 1,774 lb. Note: This slag analysis was checked by the three competent chemists at the plant and also by outside chemists.

Seven runs numbered 19-1 to 19-7: Time, 214 hours; slag, weight 4,727 lb. analyzing less than 0.01 per cent Cu and less than 0.001 per cent Pb; analysis made by laboratory of a large company and checked by our chemists; zinc, weight in slabs, 3,637 lb. in metallic form (allowed to set in the ladle before remelting); matte—the runs were so short and the furnace ran so cold on the bottom that no matte could be tapped. It was recovered, on breaking up the furnace, with considerable metallic iron and lead. Of the ore charged, the maximum carried 7.20 per cent Pb, and 1.82 per cent Cu; estimated average content of charge 4 per cent Pb and 0.75 per cent Cu.

Prior to this we sampled a dump containing approximately 6,000 lb., comprising about 40 taps from a half dozen or so short runs, and sent the sample to a public assayer. He reported 0.65 per cent Zn; 0.12 per cent Cu; 0.0 Pb; 0.15 oz. Ag; and 0.00 oz. Au. The ores used in these runs were of various analyses, but resembled on the average the ores of the runs 19-1 to 19-7, except that one parcel analyzed 3.5 per cent Cu.

In our later work, the slags did not average so low, for the design of the furnace was changed and the process modified for the main purpose of obtaining slab zinc, copper matte and lead, sacrificing our ability to produce low slags for the more important objectives. In Run 26-1, lasting 41 days 1.5 hours, there were treated 60,525 lb. ore of an average analysis of 36.67 per cent Zn, 9.40 per cent Pb, 1.11 per cent Cu; there were produced: Slab zinc, 17,245 lb.; dross and bullion, 2,752.3 lb.; 3,478 lb. matte, analyzing 12.62 per cent Cu and 9.07 per cent Pb; and 45,850 lb. slag carrying 0.24 per cent Cu and 0.15 per cent Pb. This, while lower in value than the

usual lead slag, is not nearly as clean as when we had a better reduction and a better settling inside the furnace. The slag in this run averaged 6.09 per cent Zn. It was kept purposely high in order that there would be enough zinc oxide in it to scorify any metallic iron formed. Otherwise, the bottom would have built up with an iron sow because of periods of accidental over-reduction. In commercial work the settling and final dezincifying should be performed separately.

The slags made in the work had a varied analysis, from 25 per cent SiO_2 to 55 per cent SiO_2; FeO from nothing to 20 per cent; CaO plus MgO from 15 per cent to 35 per cent. In general they stand between those of a lead blast furnace and those of an iron blast furnace.

The cleaning of the slag is thus not due to any special feature of slag composition. In short, with the intense reduction present, with the extreme fluidity of the slag due to the electric superheating and with the electro-mechanical forces set up in the slag, the copper, lead, silver, and gold had no chance to go anywhere except out of the slag. As was stated above, no attempt was made to produce this result, but it came incidental to other aims. The force, however, is so powerful that were it directed for that end there is no doubt that phenomenally clean slag could be regularly produced on a large scale without difficulty. I am inclined to believe that the operation might be a commercial one when operating on ordinary hot slags, apart from the recovery of any zinc. It would seem that electrical action offers a simple way to clean hot slags, and also by reversing the process, of cleaning hot metal, such as steel, from slag and other bodies which appear in the ingot as solid non-metallic impurities and are fertile causes of failures in steel. To accomplish this by purely mechanical means seems out of the question for the reason mentioned in your editorial. WOOLSEY MCA. JOHNSON.

Hartford, Conn.

Magnetic Separation of Complex Lead-Zinc Ores

THE EDITOR:

Sir—Reading the discussion by E. Hedburg on the subject of magnetic separation in your issue of May 26 brings to mind the treatment given Colorado ores. At one mill I recall, the treatment ten years ago was much simpler than the one described by Mr. Hedburg.

The ore was crushed by breakers and rolls to about half-inch and then stocked. After passing the drier it was rolled to 20 mesh. Then it passed to Herreschoff furnaces, modified by having four additional hearths superimposed on the original five. These were afterward replaced by Skinner roasters. The ore was given a magnetic roast. This consisted of eliminating approximately one-half the sulphur combined with the iron. From here the partially roasted ore was cooled, then passed through magnetic separators, by which an iron product was removed. The tails then went to a classifier and then to Wilfley tables, on which a lead concentrate and a zinc concentrate were produced.

The iron product ran about 40 to 45 per cent iron, 6 per cent lead, 6 oz. silver and .02 to .03 oz. gold.

The lead concentrate ran 60 per cent lead, 15 oz. silver, and .12 oz. gold.

The zinc concentrate ran 45 per cent zinc, 4½ per cent lead, 3 oz. silver, and .02 oz. gold.

The phenomenon of having the silver and most of the gold as coating on the zinc, as described by Mr. Hedburg, would not, I presume, apply to the ores from all districts. The roast given the Wisconsin ore is evidently of a different character from that used on the Colorado ore. It would seem that for the subsequent reduction with oil, there must be a ferric coating formed first. J. H. HASTINGS.

Donora, Pa.

The Twelve-Hour Day

THE EDITOR:

Sir—There has been much discussion of late about the twelve-hour shift in the steel works. It is said that to change from a twelve-hour shift will increase the cost. It is the opinion of many, however, that such a change should not. There are superintendents in the non-ferrous metallurgical field who have made the change from a twelve to an eight-hour shift without increasing the costs and in some cases have actually cut them. It is my experience that men cannot give good service continuously for twelve hours, and, further, that the long shift when changing is so fatiguing that men who work steady are never rested.

In 1913 I had charge of a lead refinery where the men worked twelve-hour shifts. The company decided to change to eight hours on April 1 to bring the department in line with others in the same plant. The decision was made March 1, so we had one month's notice. When the question of rates came up the director responsible for the operation of the plant decided that the twelve-hour men should receive for eight hours exactly what they were getting for twelve—a 50 per cent increase. The rate for general labor was increased about 20 per cent.

I had made a careful and intensive study of every operation, and before April 1 arrived I had my plans ready. I had gone over them with my foremen, who agreed that they were feasible. It is a matter of record that I actually cut the costs.

Laurel Hill, N. Y. GEORGE G. GRISWOLD.

The Iron Mountain Mine

THE EDITOR:

Sir—I have read the statement on page 1121 of the issue of June 23, 1923, regarding Iron Mountain, Mo. Since it contains parts that are not true, in justice to myself and others I feel I must write you the facts.

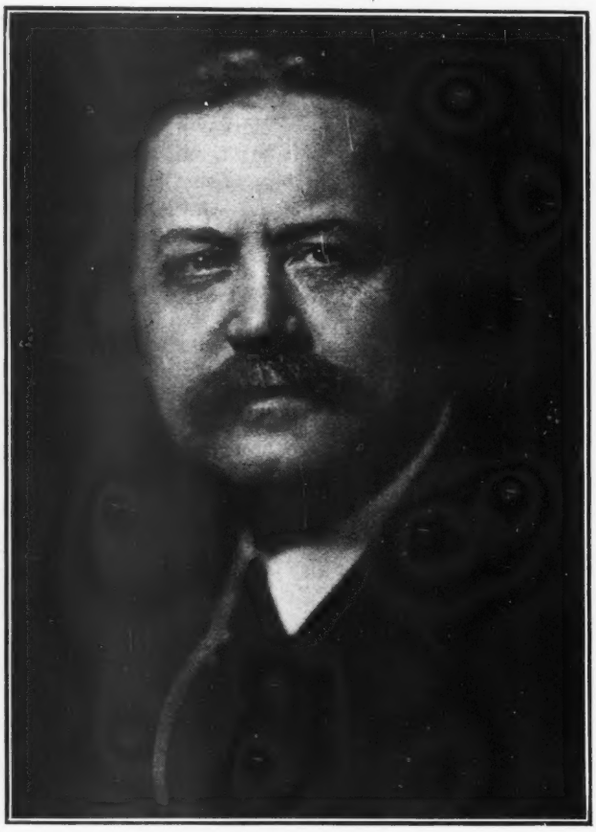
I became superintendent of Iron Mountain in November, 1919, when the mine was regarded as having been worked out, and several months before Mr. Busby bought it, continuing to hold this position until July, 1922, at which time the future of the mine was assured. I resigned and accepted my present position with the Wayne Iron Corporation, which is also engaged in developing iron mines. I wrote Mr. May early in 1920 offering him the position of assistant superintendent, which he accepted. He had nothing to do with the working out of the geology and very little with the underground development, as his time was almost entirely taken up in the office and on surface construction. He is now superintendent. Mr. Busby bought the mine in 1920, not as a stock farm but as a mine, and retained me with my staff to continue its development. During my connection with Iron Mountain we shipped nearly 45,000 tons of iron ore in spite of the long period of depression, when we shut down everything but the pumps. VAUGHAN M. LAVERY.

Williamsville, Mo.

Metallurgists of Note

KARL EILERS

A BIG custom smelting enterprise is a complex business. It is possible, however, to divide its many ramifications into two groups. One is represented by the New York office; the other by all the rest of the "show." In New York the money is obtained to finance expansion; the metal is marketed; sundry gentlemen from Washington are instructed and advised; golf courses are kept busy; and the profits are distributed—this last being perhaps the most important activity. Also, time is found to look over the reports from the plant or plants where the actual work of getting something marketable out of the ore is accomplished. If you are sitting in a comfortable chair in a spacious office in a New York skyscraper, it is easy to be critical of the metallurgical results obtained amidst the smoke and dust and heat and sweat of a smelter in Arizona. If the report shows the recovery of only 98 or 99 per cent of the silver that was received at the plant, when it has been established that 99.6 per cent is obtainable, it is perhaps only natural to indict, condemn, and sentence the local manager. It is natural, we think, unless you happen to have come up through the ranks yourself and know the tribulations of running a smelter. Then you know that it is not always possible to buy the ores that are needed for the ideal charge; you know the difficulty of obtaining and keeping good furnace men; you know a dozen kinds of problems that continually arise around a plant that the uninitiated never dream of. But if you do know these things, you will be slow in your condemning, and you will get better results in the long run. Such a man is Karl Eilers, who, prior to April, 1920, was first vice-president of the American Smelting & Refining Co., in charge of operations in the United States. From 1903 to 1920 his headquarters were in New York, but twice each year he swung around the circle to each of the A. S. & R. smelting plants. He knew the plant executives, their wives, and their children, and the troubles and joys of all of them. His coming was an event. These men in the field felt that in "Karl" (as he was affectionately known to the older men) or "K. E." (as he was no less affectionately known to the younger ones) they had a staunch friend at court—meaning the New York office. They felt that he understood the difficulties that confronted them, and they knew that from him they would get a square deal. Karl Eilers' father was Anton Eilers, generally regarded as the dean of lead smelting in the United States. Karl was born in 1865. He was graduated from the Columbia School of Mines, and after two years of study abroad he started his smelting career as assistant assayer at Pueblo. After ten years of operating experience as superintendent at various plants, the A. S. & R. company was formed, and he had charge of operations in Colorado and Utah before coming East. Mr. Eilers married Leonie Jeannette Wurlitzer in 1896, and they have two grown sons and a daughter. Early in 1920, Mr. Eilers became convinced that the Messrs. Guggenheim, who dominated the administration of A. S. & R. affairs, were exploiting the company for the benefit of sundry companies in which they were the principal stockholders. They had in the meantime disposed of most of their A. S. & R. stock holdings. He resigned from the directorate and waged a campaign to get control away from the Guggenheim family. In this he failed; but he put up a good fight, the consequence of which was the naming of a large number of outside financiers on the board which had previously been composed largely of salaried employees who held their jobs at the pleasure of the president of the company. Since 1920 Mr. Eilers has looked after extensive private interests.



KARL EILERS

As 2 o'clock approached at the annual ball of the A.I.M.E. last February, the less youthful and less vigorous of the male dancers had fallen by the wayside. Among the survivors were numerous beaux of debutante daughters, and two easily distinguished and very distinguished gentlemen. One was E. P. Mathewson, the newly elected president, who may have stayed because he thought he ought to; the other was Karl Eilers, who, it seems to us, must have stayed because he wanted to. As a successful metallurgist and executive Mr. Eilers is conspicuous; as a man he is approachable, considerate, friendly and decidedly human.

A Big Zinc Mine in New York State

27,000,000 Lb. of Metal per Year Present Production Rate of Northern Ore Co.'s Edwards Property—Annual Output Since 1915 12,000,000 Lb. in Form of Concentrates

By W. R. Wade and Alfred Wandke
Manager and Consulting Geologist, Respectively, of Northern Ore Co.

IN THE NORTHERN PART of New York State, at Edwards, in St. Lawrence County, the Northern Ore Co. has each year since 1915 been producing concentrates containing 12,000,000 lb. of zinc. These zinc concentrates are remarkably free from lead, containing on the average less than one-tenth of 1 per cent of that metal.

The paint and rubber industries consume an enormous quantity of zinc oxide each year. To make pure zinc oxide for these trades demands ore free from lead. The Edwards concentrates command a premium, because of their remarkable suitability for the manufacture of high-grade white oxide.

Zinc First Noted in 1838

Zinc ore was first reported in the Edwards district by Ebenezer Emmons in 1838.[1] He referred to the occurrence on the Balmat farm in Fowler Township about seven miles from the Edwards mine. This Balmat vein contains considerable lead associated with the zinc and iron pyrite. At that time lead was the metal sought, but the combination of minerals evidently made the ore too difficult to treat, for after sinking a shallow shaft the property was abandoned.

There is no record of any further metal mining in the district until sixty-five years later when zinc ore was uncovered on the Joel White farm in Edwards while quarrying rock for ballast on the Trout Lake wagon road.

T. M. Williams, who was at that time engaged in iron ore operations for Pilling & Crane near Gouverneur (about 15 miles distant), heard of the discovery and visited Edwards. Recognizing the possibilities of the deposit, he secured leases for Pilling & Crane on the Joel White and the adjoining Robert Brown farms. The outcrop, which had a width of 15 to 20 ft. exposed on the White farm, was a mass of impure limestone mixed with sulphides of zinc and iron that assayed from 18 per cent to 22 per cent zinc. Later developments proved this to be one of three roughly parallel veins, two of which came to the surface. So far as known at present the apex of the third is 650 ft. deep.

Mining men and geologists who saw the deposit at this early stage in its development were very discouraging in their opinions, as none of them believed that a really valuable zinc mine could exist in this part of New York State. They failed, however, to take into account the numerous and extensive deposits of pyrite and iron oxide in the neighboring townships as evidence that this section had received extensive mineralization and that the occurrence of profitable zinc orebodies was within the range of possibility.

Pilling & Crane began a development campaign, but operations stopped in 1905 because of legal complications and were not resumed until 1910. When sufficient ore had been developed, the first mill was constructed, but this plant proved unable to produce a marketable concentrate. A long period of experimentation followed, the object of which was to discover a means of freeing the concentrate from the large amount of iron pyrite it contained. Practically all known processes were tried, including roasting and magnetic separation, but without success. Finally Joseph Weatherby invented an electric separator that raised the gravity concentrate from 30 to 50 per cent zinc, making two products from the pyrite-zinc concentrate—namely, shipping zinc sulphide running 50 per cent zinc, and iron pyrite. The iron pyrite could be sold for its sulphur content to the acid burners.

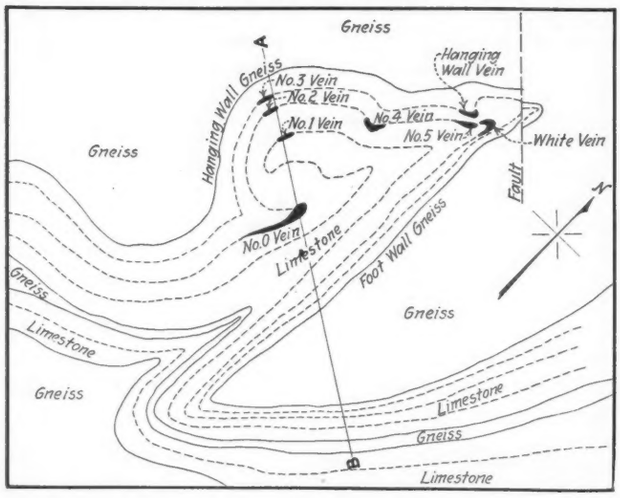
Company hotel for unmarried employees

A new concentrator was then constructed and milling operations again begun. After operating five days and before actually proving whether or not it could successfully treat the Edwards ore, it caught fire and burned to the ground. The firm had by this time become thoroughly discourgaed with the enterprise, as after ten years of expenditure of money and energy, the undertaking was but little advanced from where it had started. Great credit is due T. I. Crane, for despite all these discouraging events and in the face of the European war, which broke out at this time, he began constructing a third mill at Edwards. This plant was completed in 1915, and steady shipments were begun. With the high zinc market during 1916 and 1917 the property, due to Mr. Crane's foresight and courageous determination, entered the producing ranks at exactly the proper time. It had secured a smelting contract before 25c. zinc was ever dreamed of and this enabled it to make handsome profits which it would not have secured a little later, as most smelter contracts made after the big rise in zinc began provided against the mines sharing in these prices to any great extent.

The geology and the genesis of the zinc ores of the

[1]Geology of New York: Report on Second District, Assembly Doc., 1838, No. 200, p. 213.

Edwards district have been dealt with at some length by D. H. Newland[2] and C. H. Smyth, Jr.[3] Although the writers are in accord with both Mr. Newland and Mr. Smyth as regards many of the interpretations of occurrence, the recent intensive development campaign has added considerable new information which it seems



Geological map of 800 level of Edwards mine

worth while to bring before those interested in the geology of zinc ores.

The Edwards district lies close to the northwestern border of the Adirondacks. The rocks are complexly folded pre-Cambrian (Grenville) quartzites, schists, gneisses and crystalline limestones with which are associated somewhat gneissic intrusives. Gneissic granites and pegmatites are the dominant rock types produced during the intrusive period, although over wide stretches the schists and quartzites have been altered to gneisses by a "lit par lit" type of granitization. In these gneisses tourmaline, albite, orthoclase and quartz are common minerals. Locally portions of the limestone were altered almost completely to diopside and to tremolite, which, in turn, were altered to talc. Here and there the limestone underwent a type of contact metamorphism with diopside, phlogopite, pyrite, pyrrhotite, galena, sphalerite, tourmaline, molybdenite, chalcopyrite and magnetite among the minerals produced. The zinc ore deposits which will be discussed in more detail are considered to be related to this period of igneous activity.

Erosion affected the outcrops of these pre-Cambrian rocks and must have cut off thousands of feet, thus bringing the ore deposits nearer to the surface. The eroded surface was then buried by Paleozoic sediments, the Potsdam sandstone being the first member of this rock series to cover the fairly smooth pre-Cambrian surface. Later erosion, following the period of uplift which closed the Paleozoic period, removed part of the overlying Paleozoics and again exposed the pre-Cambrian rocks. During certain stages in the glacial period the region seems to have been relatively higher than it is at present, for in the vicinity of the mines 200 ft. of sand and silt fill an old stream channel. Subsequently these deeper channels were filled by glacial sands and gravels which are now being cut into by the present-day streams.

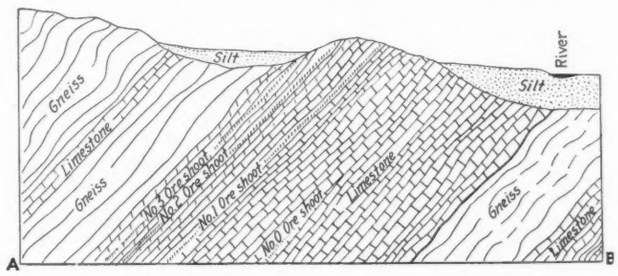
The sediments of the district with a general homoclinal dip of N. 45 deg. W. have been compressed into overturned folds. Although detailed field work has not been done it seems probable that more than one bed of limestone is interbedded with several beds of shale and quartzite.

In addition to the major folds that dominate the structure there are crumplings which, although present in the shales, gneisses and quartzites, are best seen in the limestone. As will be shown later, these cross folds are considered to be of economic importance, for they appear to have increased the permeability of certain limestone horizons, thus giving the ore solutions paths of ascent and permitting the attack of the rock which resulted in the precipitation of the sulphides and other associated minerals.

Faults producing marked dislocations have not been encountered. The northeast boundary of the White orebody is a fault boundary. This particular fault is post ore. The limestone pinches out to the northeast of the fault and is in addition poorly mineralized.

Ore Chiefly Pyrite and Sphalerite in Grenville Limestone

The Grenville limestone in which the zinc ore occurs extends from Sylvia Lake in the township of Fowler to just northeast of the town of Edwards, a distance of about eight miles. This limestone belt has a maximum width of about one and a half miles. Within this area of limestone are several interbedded layers of gneiss and quartzite. Granite and granitized gneiss surround the limestone. The various zinc and talc deposits in this limestone always occur near the bordering gneiss. Although the workable deposits of sphalerite have been found only in the limestone, it is of interest that a little sphalerite is present in a pegmatitic streak in the gneiss associated with albite, calcite, quartz, pyrite.



Vertical section along line A—B on map of 800 level

The ore consists essentially of pyrite and sphalerite (the variety commonly known as black jack) which replace certain horizons in the limestone. Associated are a little galena, pyrrhotite, and chalcopyrite. The common gangue minerals are diopside, calcite, talc and serpentine. A very little limonite occurs in the croppings and along the fault at the east end of the White orebody.

The following analyses show the character of the ore:

Analysis of Ore

	Average Mill Feed for 1 Year Per Cent	Crystals of Black Zinc Sulphide Per Cent	High Grade Ore from Various Horizons No. 1 Per Cent	No. 2 Per Cent	No. 3 No. 2 Ore Sh't Per Cent	No. 3 White Shoot Per Cent
Zn	16.91	61.59	51.53	43.43	37.74	43.79
Fe	8.72	5.36	9.14	11.75	17.87	16.06
$BaSO_4$	1.20	.....	.....	.....	.....	.....
SiO_2	16.15	.....	.....	.....	.....	.....
CaO	10.96	.....	.....	.....	.....	.....
MgO	12.61	.....	.....	.....	.....	.....
S	17.31	33.05	.....	.....	.....	.....
Pb	0.12	.....	.....	.....	.....	.....

As mined, the ore carries about 17 per cent zinc.

[2] *Economic Geology*, 1916, p. 623.
[3] N. Y. State Museum Bulletin, No. 201, 1917.

This, as is described later, is concentrated to shipping ore which carries about 50 per cent zinc.

The general order of formation of minerals in the crystalline limestone has been somewhat as follows: diopside, phlogopite, pyrite, magnetite, molybdenite, pyrrhotite, sphalerite, galena, chalcopyrite, talc, calcite and serpentine. We find, however, that a little pyrite may locally vein the sheared sphalerite; that a little talc was deposited after some of serpentine; and that a little sphalerite may replace serpentine. But for the serpentine as a whole there is every indication that it follows the sulphides and was deposited in the waning stages of the ore-depositing period.

The details of occurrence of some of the more important minerals are as follows:

Diopside has been found at a number of places intimately associated with ore and as a replacement of certain horizons in the limestone. It alters to talc and to sepentine. The serpentine may replace the diopside directly or may replace talc which is an earlier alteration product of the diopside. In the main parts of the orebodies diopside has usually been entirely replaced and is generally encountered only along the margins of the oreshoots. Unassociated with ore it is found directly at the surface and unaltered.

Pyrite and Sphalerite Only Abundant Sulphides

The sulphides, pyrite, pyrrhotite, sphalerite and galena follow the diopside in the order named. Of these minerals only the pyrite and sphalerite are at all abundant, the pyrrhotite and galena occurring as minute grains in the sphalerite. The pyrite presents no unusual characteristics except that both porous and massive crystals are seen, suggesting changing conditions of mineral formation. The sphalerite, the variety black jack, is found in various dark-colored shades. A very little pure white sphalerite was observed. The ferrous iron content of the sphalerite is sufficient to permit a magnetic concentration. It is of interest that all of this black sphalerite carries pyrrhotite in microscopically visible grains.

The molybdenite occurs in extremely altered limestone in association with diopside, pyrite, pyrrhotite, sphalerite and galena. In our specimens the molybdenite is present in crystals half an inch across. In polished section this mineral may be seen enclosed by pyrrhotite and chalcopyrite. The presence of this mineral is taken as a clue to indicate that the ore-depositing solutions were high temperature solutions.

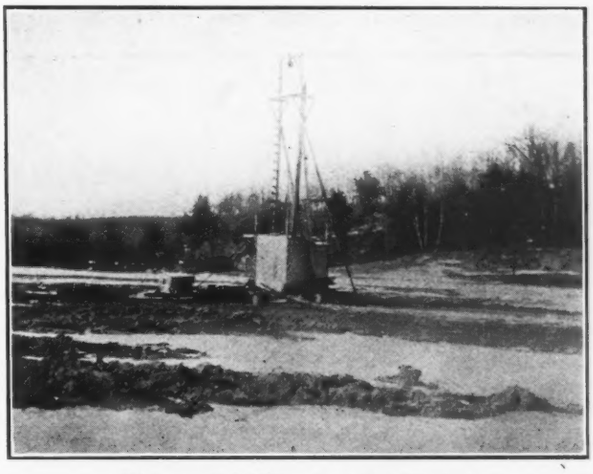
Magnetite in one instance is intergrown with pyrite and sphalerite. The specimens examined came from a 2-ft. vein of ore cut by a diamond drill in exploring the country between the Brown and the White orebodies. The intergrowth is another indication of the primary hypogene nature of the sphalerite.

Talc stands intimately related to the pyrite and sphalerite in point of time of formation. It appears, however, to be slightly later than these minerals, for they rarely ever replace talc. It forms pseudomorphs after the diopside and also replaces the calcite. It is replaced by serpentine. Smyth mentions that talc from this district replaces tremolite. While this is undoubtedly the case in the talc mines, in the Edwards zinc mine tremolite is only rarely seen and in not a single one of our thin sections was either this mineral seen or pseudomorphs of talc after it.

Serpentine is an abundant gangue mineral, being found intimately associated with ore and also unrelated. It appears to be distinctly later than the sulphides which it veins and the diopside, calcite, and talc which it replaces. It occurs in disseminated grains or forms replacement areas several feet in section. It is present at all depths in the mine apparently unrelated to any particular watercourses or groundwater level. Our interpretation is in keeping with that of Smyth that serpentine is a late magmatic mineral.

Ore Solutions Probably Moved up Dip

As has been mentioned, the limestone dips about 45 deg. to the northwest. Upon these northwest dipping formations cross folds have been impressed. These cross folds apparently opened up certain horizons, thus permitting the ore solutions to circulate. The portions



Diamond drilling a 1,300-ft. hole

of the limestone thus traversed were replaced in part to form the present orebodies. Cross fissures cutting the limestone that might have permitted the introduction of the ore solutions have not been observed in the mine workings. The few narrow fissures that are present cut the orebodies and carry serpentine, calcite, and light-colored sphalerite. In the absence of throughgoing fissures one is forced to the conclusion that the ore solutions moved up the dip along the permeable horizons.

Three principal ore horizons have been developed in the mine. The No. 3, in which the No. 3 and the White orebodies are found, is about 100 ft. below the hanging gneiss; the No. 2 fissure, with the No. 0, No. 2, No. 4 and No. 5 orebodies, is 150 to 200 ft. below the hanging gneiss; the No. 1 fissure, carrying the No. 1 orebody, is 250 to 350 ft. below the hanging gneiss.

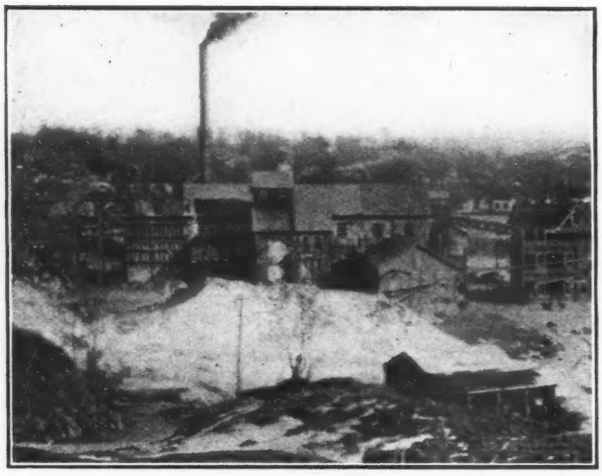
Orebodies Persistent Down the Dip

The orebodies, although rarely having a stoping length of more than 400 ft., are nevertheless characterized by a marked persistency down the dip. The No. 0 orebody apexes 650 ft. vertically below the surface and has been followed down the dip for 550 ft. The average width of the orebody is about 8 ft., but at its northeast end the ore replaces a decidedly crumpled portion of the limestone. As a result the orebody, normally only 8 ft. wide, here suddenly widened to 30 ft. of solid sulphide running 30 per cent zinc. The No. 1 orebody has a stoping length of 320 ft., an average width of 4 ft. and is explored down the dip for 1,300 ft. This No. 1 orebody is high-grade: practically

all of the minable ore above the 500 level ran 30 per cent zinc. The No. 2 orebody has an average stoping length of 200 ft., an average width of 5 ft. and has been explored down the dip for 1,260 ft. The White orebody is 150 ft. long, 15 to 40 ft. wide and has been explored for 1,300 ft. along the dip. The No. 3, No. 4, and No. 5 orebodies have been developed by diamond drilling and drifting from the 800 level. None of these orebodies outcrops. From present indications they are of good grade and will add materially to the life of the mine.

Ores of Magmatic Origin

The origin of zinc ores in limestones is subject to two explanations: (1) They were concentrated from the surrounding rocks by meteoric solutions; (2) they were deposited by magmatic solutions emanating from a not far distant intrusive igneous mass. The Mississippi



Northern Ore Co.'s 250-ton mill, looking east

valley zinc ores have been considered by a great many as due to concentration by circulating meteoric solutions; contact metamorphic zinc deposits are ascribed to precipitations from magmatic solutions. Smyth has already stated that in his opinion the Edwards zinc ores were deposited by magmatic solutions related to the near-by granite and the ores were localized "to fractures or planes of weakness in the limestone through which the ore-bearing solutions circulated."

Our work has added other facts which corroborate the view that the Edwards zinc ores are of magmatic origin.[1] Five of the most striking bits of evidence are: (1) the occurrence of zinc in a streak of pegmatite in the gneiss associated with albite, quartz, calcite, and pyrite; (2) the presence of zinc in limestone intimately associated with tourmaline, phlogopite, molybdenite, diopside, pyrite, pyrrhotite, and calcite; (3) the constant presence in the zinc of minute particles of pyrrhotite, galena, and pyrite and rarely of chalcopyrite; (4) the intimate intergrowth of sphalerite and magnetite with pyrite; (5) the fact that the gneiss hanging wall is injected with pegmatite, and that the main orshoots occur only under gneiss so injected.

The mine is opened by three shafts, two of which are operating at the present time. The Williams shaft is a two-compartment incline going down 800 ft. It is sunk on the No. 3 horizon in the White oreshoot. The hoisting equipment consists of two skips of 1 ton capacity each, and operated by a double-drum electric hoist. The Brown shaft is a single-compartment incline, 500 ft. deep, and is now used only as an exit for pump columns. A vertical shaft, 900 ft. deep, has two compartments. It is 1,000 ft. northwest of the Williams shaft. It is equipped with a cage, below which is hung a 1½-ton skip. The hoist is a 150-hp. Allis-Chalmers electric single-drum hoist using alternating current at 2,300 volts. The skip and cage are counterweighted through the hoisting drum. This hoist has capacity for 1,100 ft. of rope and a speed of 1,000 ft. per minute. The skip is charged from loading pockets at the 540 and 840 levels and dumps into a bin built into the headframe. This shaft and hoist has a capacity of 600 tons per twenty-four hours. The ore is hauled on the surface to the mill by a Plymouth gasoline locomotive. This machine has proved to be economical and reliable. In fact it has not been out of service a single working day for five years.

Compressed air is furnished by two electric-driven compressors, one a 1,600-cu.ft. Ingersoll-Rand, and the other a 500-cu.ft. Sullivan. The hoist house and compressor house are built of concrete blocks.

Shrinkage Stoping Used—Heavy Flow of Water

Stoping is done almost entirely by the shrinkage method. The ore is drawn through chutes with openings 36 in. x 40 in. These large chute mouths are necessary, as the ore is very hard and breaks into big pieces. Thirty-five per cent gelatine powder is used in blasting, but experiments now being carried on point to 50 per cent as more economical for stoping because it breaks the ore into smaller pieces, thereby reducing the amount of block-holing in the chute mouths. This also increases the tramming efficiency more than enough to offset the increased cost of powder.

The mine makes a large amount of water, about 800 gal. per minute. This is pumped by stages with lifts running from 300 to 360 ft., as follows: Two electric-driven single-stage centrifugal pumps on the 900 level relay the water to the main pumping station on the 840 level. Here two three-stage centrifugal pumps with a capacity of 300 gal. each per minute, driven by 50-hp. motors, relay the water to the 540 level, where it is again relayed by similar equipment to the 240 level. At the 240 level the water from both the Williams shaft, flowing 200 gal. per minute, and the vertical shaft, 600 gal. per minute, is collected at the Brown incline. This is a main pump station equipped with three centrifugal pumps having a combined capacity of 1,000 gal. per minute. A fourth pump is to be installed. About 450 hp. is required for pumping purposes alone. All pump stations are equipped with a spare centrifugal pump and auxiliary air-driven pumps to be used in an emergency.

Two hydraulic-feed diamond drills are used in prospecting from the surface and one hydraulic-feed diamond drill underground. Holes range from 500 to 2,000 ft. deep.

Power Purchased—Mill on Flat Site

The power required to operate the mine and mill, amounting to about 1,100 hp., is purchased from the Northern New York Utilities Co. However, to guard against flooding the mine in case of power trouble the

[1]Similar ores in similar rocks have been described from Long Lake, southeastern Ontario, by W. L. Uglow, *Econ. Geol.*, Vol. 11, 1916, p. 231. He concluded that the orebodies were formed by strictly metamorphic processes as distinct from the metasomatic phase of contact metamorphism. The ores are believed to be concentrations by meteoric solution.

property has an auxiliary steam plant consisting of four boilers and two steam-driven electric generators, having a combined output of 350 kw. The power comes in at 11,000 volts to the company's transformers. Here it is stepped down to 2,300 volts for use at the vertical shaft and compressor house, while other transformers step it down to 220 and 110 volts for the motors in the mill and shops and for lighting purposes. The transformer house is a reinforced concrete building of fireproof construction.

The mill building is constructed of steel and hollow tile. Because of the slight diversity in topography the mill was built on a flat. This necessitated the operation of tables on several floors vertically over each other. To prevent the vibration from destroying the outer walls of the building the several floors are supported by steel columns and are not connected in any way with the walls of the building.

The mill has a capacity of 250 tons per day. The ore is dumped into a bin at the top of the mill from which it goes through a Blake jaw crusher, then a Symons disk and is then handled by an elevator to the crushed-ore bin. This is a circular steel tank of standard construction. From this storage tank the ore goes to Allis-Chalmers rolls grinding in closed circuit with a trommel screen. The ore between 4½ and 8 mesh is sent to a three-compartment Hartz jig, and the ore finer than 8 mesh is sent to Diester-Plato tables. The middlings are reground and re-treated on other tables, and the slimes are treated on slime tables. At every point where a band of lead appears on any concentrating table the lead is cut out of the general concentrates.

PYRITE REMOVED ON WEATHERBY ELECTRIC TABLES

The crude ore contains so much pyrite that a shipping concentrate cannot be made on the jig or gravity tables. The average concentrate thus far contains only 30 per cent zinc. The ore is now sent to Weatherby electric tables, where two products are made—50 per cent zinc concentrate and clean iron pyrite containing about 6 per cent zinc. The electric tables consist of a steel riffled deck operated by a standard table head motion. There are two powerful magnets just over and under the steel deck. The zinc sulphide, as shown elsewhere, contains about 5 per cent iron. The iron is ferrous iron and therefore is affected by a powerful electromagnet. The iron in the pyrite is ferric iron and so is unaffected. The result is that the zinc floats over the tops of the steel riffles while the pyrite follows the riffle grooves to the end of the table. The action is similar to that of any concentrating table except that pyrite comes out where the concentrates should, whereas the zinc, made buoyant by the magnetic force, crosses the riffles like gangue and discharges where tailings do under ordinary conditions.

These machines are well adapted to the Edwards ore. They have the added advantage of sending the slight amount of lead in the table concentrates along with the pyrite. The company sells both zinc concentrates and iron pyrite. In normal times it finds a ready market for the pyrite among the acid makers.

A tailing plant re-treats the tailings from the main mill. The combined extraction of the two plants is 85 per cent. Plans are now under way to get a still greater recovery by a re-treatment on dry magnetic separators of the reject pyrite containing 6 per cent zinc and by installing additional equipment in the tailing mill.

Since Jan. 1, 1923, the production of the mill has been more than doubled, so that it is now running at the rate of 27,000,000 lb. of zinc per annum. Over 330,000 tons of ore has been milled to date.

The Edwards mine has shown steady improvement with depth. The orebodies are larger and richer at present than at any other time in the history of the company. The ore is of deep-seated origin formed under conditions of high temperature and there is every reason to believe that it will continue well below the bottom of the present workings. While it is possible that individual oreshoots may give out, experience shows that others are found at greater depths. There may be times in the future (if exploration is not carried ahead vigorously enough) when the ore reserves will appear to be giving out, but we are of the opinion that intelligent prospecting at greater depth will find more ore.

Tunisian Phosphate Production

The Compagnie des Phosphates et du Chemin de Fer de Gafsa, which practically controls the entire Tunisian phosphate production, has just published its annual report for 1922. The mines of Metlaoui produced 671,805 tons and those of Redeyef 666,461 tons, or a total of 1,338,266 tons. This was an increase of 171,636 tons as against 1921. This increase was due to incessant endeavors to enlist new workmen, which, the report says, is a very difficult task in Tunisia. Work on the new phosphate mines at Moulares was continued during the entire year and shipments from these mines, via the port of Susa, will begin during 1923. The total exports during 1922 amounted to 1,545,730 tons, of which 1,292,730 tons went via the port of Sfax, and 253,000 tons via Susa. After the crisis of 1921 the demand for phosphates largely increased in France, Italy and Spain, and Belgium, while in other countries the consumption has not as yet reached its normal increase. In 1913 the superphosphate factories of the European Continent received 4,350,000 tons of phosphate and during the ten previous years the annual demand increased by about 240,000 tons. At present, they are still far behind their former consumption. After the close of the war their purchases reached 3,200,000 tons in 1920, fell in 1921 to 2,850,000 tons and reached 2,500,000 tons in 1922.

Unusual Variety of Queensland's Mineral Resources

Systematic and energetic action is being taken to bring before the world at the British Empire Exhibition next year the great variety of mineral wealth in Queensland, Australia. In the commonwealth it is acknowledged that this, the most northern of the states, has resources in economic minerals of greater variety, perhaps, than any similar area in the world. Of these minerals practically all are represented.

Particularly in the rare-metal group is Queensland rich. She has been among the greatest producers in the world of wolfram, molybdenite, and bismuth combined; and the Cloncurry district is an important copper region.

In addition to the common metals and minerals, Queensland will send manganese and fluorspar, fine china clays, opals, and sapphires, in blue, yellow, amber and green, which cannot be excelled.

Monorail Transportation for Magnesium Ore in California

Heavy Grades and Sharp Curves Features of Twenty-eight Mile Road Now Building to Deposits in Death Valley

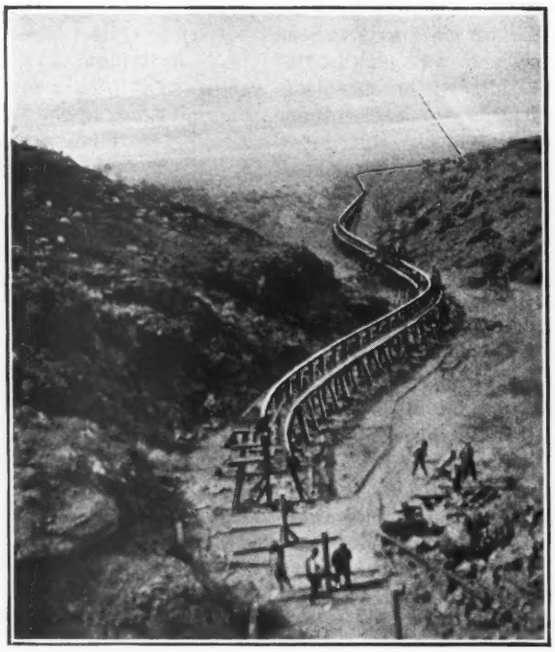
By Charles Hardy
Charles Hardy & Ruperti, Inc., New York

WHILE recently in the West I was invited by the American Magnesium Corporation, of Los Angeles, to inspect their property in Death Valley, and I was particularly interested in the way in which the company proposes to reach its holdings and to bring the ore to the railroad. A monorail has been constructed to my idea, upon entirely new lines, affording an easy and cheaper means of transportation.

A natural deposit of magnesium salts is situated in Death Valley, 28 miles from the nearest railroad, which is the line running from Searles to Trona. About six miles before the railroad reaches Trona, situated at Searles Lake, which of course is no longer a lake but only the dried bed of a lake, a new station called Magnesium has been established by the Trona R.R. This station has been used as a starting point for the monorail to the mine, and this monorail crosses the Lake salts in an 8-mile stretch, then ascends through a gorge to a higher level, and before reaching the mine has to overcome several grades up to 8 and 10 per cent. Many difficulties have to be contended with, and I believe it has only been possible to build this railroad successfully and economically because of the fact that during the whole stretch of 28 miles the company has the right of way and no river or roads have to be bridged over.

I understand that the cost of building a monorail, constructed as this one, amounts to $7,000 to $8,000 a mile, a figure which compares favorably with the cost of construction of any other kind of road.

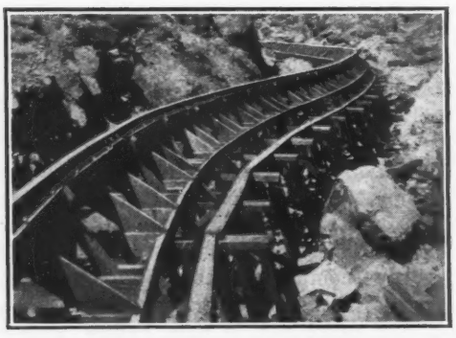
The type of construction can readily be seen in the illustrations, including that on the front cover. The structure is a wooden framework which only in rare cases exceeds a height of 3 ft. The carriage rests upon the rail like a saddle on the back of a horse, and the equilibrium is maintained by guiding rails against which the carriage presses with roller bearings. The traction is effected by a Fordson tractor built into a heavy steel frame, and it has been demonstrated that a load of 15 to 25 tons can be readily hauled in this way at the rate of 8 miles an hour where there is an up grade, and from 10 to 15 miles on the flat.



Looking west out of Layton Canyon. Road crossing Searles Lake in distance. Grade 7.5 per cent

At the time of my visit about 16 miles had been constructed and the work was rapidly progressing toward the finishing of the remaining 12 miles. The company expects to haul a ton of ore for less than $1 to its railroad station, and if this can be borne out I believe that in desert territory this is probably the cheapest transportation thus far achieved.

Magnesium is not found native, but is a common constituent of many minerals, brucite, magnesite, kieserite and carnallite being the commoner of them. Producers maintain that the metal is in the position that aluminum occupied a few years ago and that the price will become lower as the demand for it increases. The American Magnesium Corporation is one of the two companies that have produced it in the United States since the war. Competition from Germany in the future is expected to be keen, as that country will no doubt make a strong bid to recover the trade which it controlled during the war.



Left—A section in the canyon. Right—A monorail-road train.

Mining Under Fire Conditions

Methods of Extracting Copper Ore from the Coronado Mine of the Phelps Dodge Corporation at Clifton, Ariz.—Fire Originated in Timber Mat—Mechanical Ventilation Important—Ore Removed as Fire Burns—Excellent Recovery

By W. G. Scott
Superintendent, Phelps Dodge Corporation, Coronado Mine
and
S. A. Mewhirter
Chief Engineer, Phelps Dodge Corporation, Coronado Mine

THE CORONADO MINE of the Phelps Dodge Corporation, formerly operated by the Arizona Copper Co., Ltd., has suffered from a number of fires during the last five years, and two of these are still burning. Owing to the inaccessible location of these two fires, it was found impossible to extinguish them, and methods were therefore devised to continue normal stoping operations, and to extract the ore beneath the fire area, under fire conditions.

The general stoping method now employed is shrinkage; over the shrinkage stopes extends the timbered mat of former top slices. In this mat, from 40 to 75 ft. thick and about 1,500 ft. long, two fires of unknown size and origin are burning. Top slicing, the method formerly used, was not considered practicable after the outbreak of the fires.

The Coronado mine is in the Clifton-Morenci district, in Arizona. The vein is over three miles long, and varies in width from 10 to 200 ft. The mine is served by a long adit tunnel on the 1,100 level, and by a shaft (the Matilda) which rises from the tunnel to the surface at the top of the mountain. There are several other openings of minor importance. The active stopes lie west of the Matilda shaft and between the 500 and 700 levels.

Mechanical Ventilation Necessary

Prior to starting shrinkage stoping the entire orebody was divided into three sections, designated blocks A, B and C, for convenience. The stoping of the shaft pillar adjacent to block A, is now being completed, and later, when conditions warrant, the ore below the 700 level will be extracted. Mechanical ventilation has been employed throughout the entire stoping operations under fire conditions, so as to provide continuity of air currents. The main fan installation is a large, nonreversible Sturtevant pressure fan, with a capacity of 60,000 cu.ft. per minute, installed underground. The air from this fan maintains a constant pressure beneath the fire zone. It is remarkable that for a period of over two years the men have been able to continue stoping operations with more than customary efficiency immediately beneath a glowing fire.

Few Accidents Have Occurred

To prevent the natural reversal of air currents, which would occur should the electric power be cut off and the fan shut down, connections have been made to the compressed-air line. This air line is 8 in. in diameter and extends from the compressor, which is at the portal of the adit tunnel. The air has a pressure of 90 lb. per square inch, and merely opening the valve is sufficient to maintain a pressure beneath the fire stopes until the men can reach a place of safety and there await the turning on of the power.

During two years of mining in the fire area, there were no delays caused by breakage of equipment; everything worked out as planned, from start to finish, and consequently no accidents were chargeable directly to the fire. The men of the working force were subjected to the regular mining-risk accidents, but were fortunate in not having a fatal accident, nor one of serious nature.

General Description of Mine

The Coronado oreshoot varies in width from 10 to 200 ft. The vein is a fault filled with porphyry and diabase. The walls are granite or quartzite. The openings to the mine are shown in Fig. 1. The Matilda

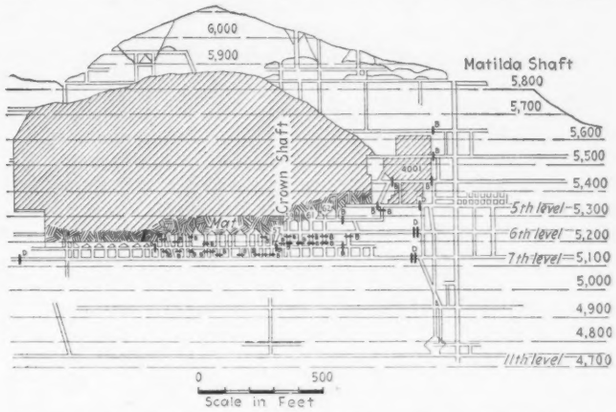


Fig. 1—Vertical projection of Coronado mine, looking north—First fire

shaft, 1,100 ft. deep, is in the vein near the east end of the orebody. Levels are driven from it every 100 ft., the bottom level connecting with the haulage, or 1,100, level. From the shaft eastward to the portal of this adit the distance is 6,310 ft.; and 3,000 ft. to the west of the Matilda shaft this level connects with the bottom of the Crown reef shaft.

The Matilda is the main air course of the mine; it is a strong upcast from October until May, and from May until October varies from downcast to neutral during the day, with a slight current in either direction at night.

The 700 level of the Matilda shaft, to the west, connects with the Crown Reef shaft, and continues through the Horseshoe mine to the surface 5,500 ft. away. This is the main ore-transfer level, and is equipped for electrical haulage throughout. From 1913 to 1916 most of the ore was extracted by flat top slicing, and from 1916 to 1918 by the inclined-slicing method. To facilitate operations, sublevels were driven 55 ft. below each level. This, with the multiplicity of raises driven for slicing, had a pronounced influence on the fire-fighting and the later mining.

The large amount of timber used in slicing (8 to 9

bd.ft. per ton) had built up a mat of broken timber from 40 to 75 ft. thick. Over this mat lies the caved burden. All of the serious fires have been in this mat, as the sulphur content of the ore was too low to support combustion.

On Aug. 19, 1917, gas was discovered on the 655 level near the air shaft, by a fire patrol. No smoke was observed. The gas was traced to 40 stope, but no fire could be found. (See Fig. 2.)

A helmet crew was called from the Longfellow Division, at Morenci. This crew spent three days in searching for the fire, as it was not realized that the fire was in the mat above the stopes. No. 40 chute was emptied and No. 04 chute partly emptied in the search. The gas continued to increase, though little smoke could be observed. In an endeavor to drive back the gas, a small fan was started near the air shaft on the 700 level, and compressed-air lines were opened in the stopes to the east of No. 40 chute. As the area was not cut off by bulkhead, this only increased the circulation of air, and in a short time the fire filled the 655 and 700 levels with gas and smoke.

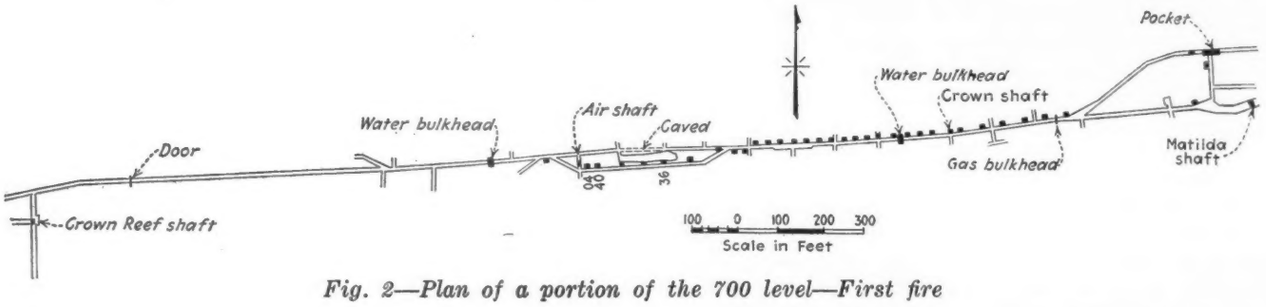


Fig. 2—Plan of a portion of the 700 level—First fire

Temporary and Permanent Bulkheads

The helmet crew closed some old doors on the 700 level west of the air shaft, but did not make them gas-tight. Bulkheads were started on the 200, 300, 400, 500, 700, and 1,100 levels to prevent the gas reaching the Matilda shaft. In erecting these, a temporary stopping was placed to the west of the point where it was desired to build the permanent bulkhead. The stoppings were made by placing small stulls across the drift and nailing on these two or three planks. Over this framework was tacked tarred roofing paper. This paper can be torn to fit the irregularities of the ground, and with a little mud a fairly gas-tight stopping can be made, which will prevent the rapid spreading of gas, where there is little pressure. The stopping can be erected in a short time by a helmet crew, whose capacity for labor is greatly reduced by the weight of their apparatus. The permanent bulkhead can then be built by men untrained in the use of the oxygen apparatus, and far more rapidly than is possible by a handicapped helmet crew.

The permanent bulkheads are made by tightly closing the drift with 1 x 12-in. plank nailed to stulls. On these are then nailed wooden lath spaced about ⅛ in. Expanded metal lath was tried, but the wooden lath was found to be cheaper and just as satisfactory. Over the whole is spread a mortar made by the following formula: Seven parts "lime mixture" to one part cement, with enough water to make a thick mortar. This lime mixture, composed of two parts lime to five parts sand, is made up outside the mine and sent in as needed. Age does not affect it, but the lime must slake forty-eight hours before using.

The mortar is put on in one coat, ½ to ¾ in. thick, and trowel-finished. This makes an inexpensive, gas-tight bulkhead that requires little upkeep, as it does not develop cracks in drying. It will not, however, stand the concussion from blasting close by.

Two fans were brought from Morenci, where they had been made in the company shops. Both were of the disk, or propeller, type. One was 5 ft. in diameter, direct-connected to a 10-hp. 1,200-r.p.m. motor. The other was 3 ft. in diameter, direct-connected to a 5-hp. motor with a speed varying from 850 to 1,300 r.p.m. Both fans were mounted on trucks, the motor being grounded through the truck to the track, and the current being furnished through a wire hooked over the trolley wire. A variable-resistance device mounted on the truck was used for speed control. The 3-ft. fan was small enough to be hoisted through the Matilda shaft.

All the bulkheads were finished by Aug. 26. Before the 1,100 level bulkhead was finished, sufficient gas had leaked through the doors on the west end of the 700 level to come down the Crown Reef shaft and out the 1,100 level, where it gassed the crew at work on the bulkhead. The helmet crew hooked up the 5-ft. fan, and under its pressure the stopping was completed. These bulkheads limited the gas to the area west of the Matilda shaft and permitted the establishment of a fresh-air base on the 700 level.

Attempts to Extinguish Fire

It was decided to approach the fire from the Matilda shaft on the 700 level, determine its size and character, and, if possible, extinguish it by direct means. The 3-ft. fan was used to force back the gas and smoke, permitting the men to work in fresh air. Helmet men were found to be extremely slow, and supervision over them very difficult, so they were used only in emergencies, for reconnaissance in the gas.

The fan was placed in position, and a temporary brattice was erected between the fan frame and the sides of the drift. The fan was then started, and the area cleared of gas and smoke. A bulkhead was built, and the fan was then moved forward. Progressing in this manner, the gas and smoke were cleared to No. 36 chute, 200 ft. east of the fire. Here additional pressure was found necessary. A No. 6 blower, belt-driven by a 5-hp. motor (1,050 r.p.m.) was mounted behind the bulkhead erected at this point, blowing through a 12-in. galvanized pipe. This pipe had ordinary slip joints, but was made leak-proof by wrapping the joints with cheesecloth several layers thick and about a foot wide, the cloth having been dipped in a very thin mixture of cement and water and being tied on with string or wire. This practice had previously been developed in driving the long haulage drifts connecting the mine with the concentrator at Morenci. It was realized that the addi-

tional air would increase the fire somewhat, but the greater increase in speed and progress, because of the larger number of men able to work in the good air, more than offset this disadvantage.

When the new blower had cleared the smoke, fire was found coming down the empty No. 40 chute, and before it could be stopped, the stope above caved, filling the level with red-hot rock and charcoal, which burned the front out of No. 04 chute, permitting the

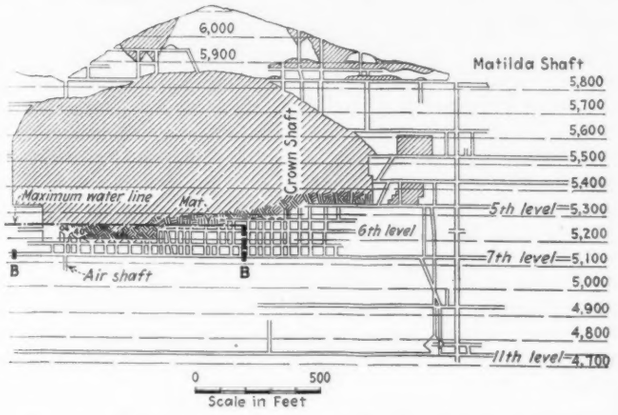


Fig. 3—Vertical projection of Coronado mine looking north—Second fire

burning mass to reach the level through this chute also. This red-hot mass had to be spiled through, and when the water was turned onto it, the steam, dust, and sulphur dioxide which were generated drove back the muckers until the mass had been wet down for several feet ahead. Even then a stream of water had to be kept on the spiling to keep it from burning. While this was being done, it was decided to attempt a passage through the old footwall drift, which had been abandoned and was badly caved. By crawling, the air shaft was reached, but the station was found to be burning and the shaft caving.

Flooding With Water

As it was impossible to extinguish the fire from below, flooding was decided upon. The mass of hot material remained to be spiled through, so that a concrete bulkhead might be built west of the air shaft. The 700 level was cleared through to the Crown Reef shaft by Oct. 18. To flood the area, four bulkheads, one on the west of the 700 and one each on the 700, 655, and 600 to the east, were necessary. These were made of reinforced concrete 4 in. thick and about 100 sq.ft. in area. The flooding seemed to be an easy task, but great difficulty was encountered in keeping the bulkheads tight, owing to the soft nature of the porphyry in which they were built. The water was finally raised to a level 120 ft. above the 700, when the bulkhead on the 655 let go. The water had softened the porphyry around the edge of the bulkhead, gradually eating its way through. Once it got through, a large hole soon formed, and the water lowered to the level. It was believed that the water had reached all the peaks of the fire, so preparations were made to resume operations. It required until Nov. 18 to complete the bulkheads, and the water reached its maximum level on Dec. 19. A 300-gal. pump at the portal of the 1,100 level furnished the water necessary for flooding.

Inside the flooded area the drifts and many of the chutes were badly caved, and a great amount of spiling was necessary to reopen them. A new drift had to be driven west of the air shaft to avoid a serious cave, but before production could be resumed in the fire area, the second fire started. The cause of this was never determined.

During the night of June 17, 1918, several men were slightly gassed in the 4,001 stope, a shrinkage stope just west of the Matilda shaft on the 400 level. The next morning the gas was traced to 63 stope (Fig. 3), an inclined slice just below the 500 level. Bulkheads were immediately built on the 400 and 500 levels, and all the chutes below the 600 were filled. While stopping 6,061 raise, a cave occurred in the burning stope above, driving incandescent dust and carbon down the raise and fatally burning three men who were directly in front. Several others who were only a few feet away escaped unhurt. Bulkheads were built on all levels west of the Matilda shaft, and on the 700 level, east of the Crown Reef shaft. The bulkheaded area (see Fig. 4) was then put under pressure by use of small blowers. These included one No. 4, direct-connected to a 2.5-hp. 1,700-r.p.m. motor on the 500 level; two No. 4 on the 600 level; a 5-ft. propellor type on the 700 at the Matilda shaft; and a No. 6 on the 700, east of the Crown Reef shaft. All were equipped with double doors forming an airlock. The air was carried through the locks in a 12-in. galvanized iron pipe, except on the 700 at the 5-ft. fan, where the air was carried through by means of a partition in the drift. No. 57 stope and the slices to the west were rushed in an endeavor to drop the mat sufficiently to cut it, and prevent the fire from extending westward, but the fire reached there before it had dropped sufficiently, came down the empty No. 57 chute, and set fire to the 655 and 700 levels, causing them to cave.

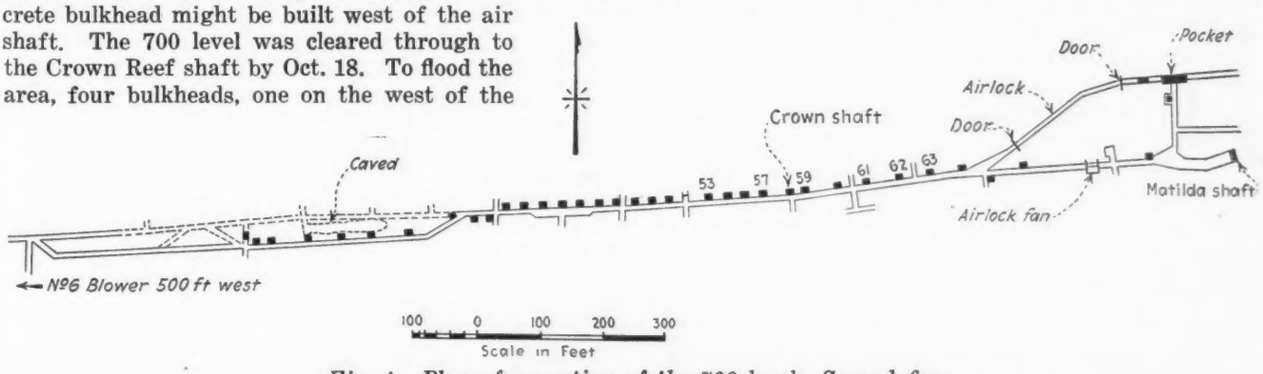


Fig. 4—Plan of a portion of the 700 level—Second fire

As flooding was impracticable to this height, it was decided to seal the fire area and attempt to smother the fire, utilizing steam to cool the burned area. A steam line was laid on the 600 level to the Crown Reef shaft,

and steam was admitted from Aug. 18 until Oct. 16; 5,000 gal. of water was evaporated per day. The area was permitted to cool until Nov. 26. Fire was discovered on the 500 level, 100 ft. east of its original appearance, the steam line was laid to this point, the mine again sealed, and steam admitted from Nov. 27 until Jan. 31, 1919. The mine was allowed to cool until Aug. 3, 1919, when preparations were again made to open the fire area. On Aug. 14, all the bulkheads were opened, with no evidence of active fire. The mine was cleared of gas, the many caves were repaired, and preparations were made to resume stoping. Natural ventilation was permitted, so as to discover any fire that might be present and to make possible the location of it.

On Oct. 31, smoke was detected on the 655 level. The mine was placed under pressure, and the fire was discovered to be on the 600 level near No. 53 stope. That the steam had a deterrent effect on the fire was evident, but it was too local in its action. In no case was active fire near the end of the steam line, although the timber was blackened and charred by the fire burning at the time the steam lines were laid. As the air supply was cut off by sealing the mine, the fire apparently climbed up through the mat, following the small amount of air circulating through the caved overburden. Here, the steam could not reach, and when air was supplied, the fire from below burned downward until it became visible. The porous overburden permitted the escape of sufficient of the products of combustion to keep the oxygen content high enough to support combustion.

Under these conditions the fire could not be extinguished by sealing, which had been so successfully used at the Clay mine fire in 1916. There the back was not yet broken, and consequently the area could be made absolutely gas-tight, forcing the fire to lower the oxygen content below the point necessary to sustain combustion.

Preparation for Mining

Having failed in all our efforts permanently to extinguish the fire, it was considered necessary to deal with it from another angle. We decided to mine out the area affected, after which we would be in a position to isolate this section from the rest of the mine, and could then let the fire take its course. Our first procedure was to prepare to put this section of the mine under pressure. A 60,000-cu.ft. high-speed fan was installed near the shaft station on the 700 level, and all the openings above the 700 level were sealed off, except at the extreme west end of the orebody, where mining was begun. For convenience in mining and ventilating, the area affected was cut up into blocks, numbered A, B and C (Fig. 5). These blocks were placed with conformity as nearly as possible to the different horizons of unstoped ore; for instance, the horizon of block C was, with few exceptions, at the 655 level; block B had a step-up which brought its elevation at the 600 level; block A showed another step-up to the 555 on the west end and inclined up to the 500 on the east end.

Each block was taken separately and handled accordingly. Block C, being a shallow area, only 45 ft. in height, did not justify much dead work. We had an old tunnel that paralleled and skirted the vein on the north, but this was in heavy ground that was partly caved, and to put it into service again would cost practically as much as a new tunnel. There was another tunnel paralleling it on the south side, but it was out in the wall about 10 ft. and had been used as a haulage tunnel in previous operations by inclining chutes back to the vein. Owing to its being so far out in the wall, the inclination intersected the vein about 30 ft. above the 700 level, and to continue using this tunnel would mean that we could not extract the ore below where the chutes would intersect the vein, so we were left with no alternative but to run another tunnel between the two old ones, along the vein and as near center as possible.

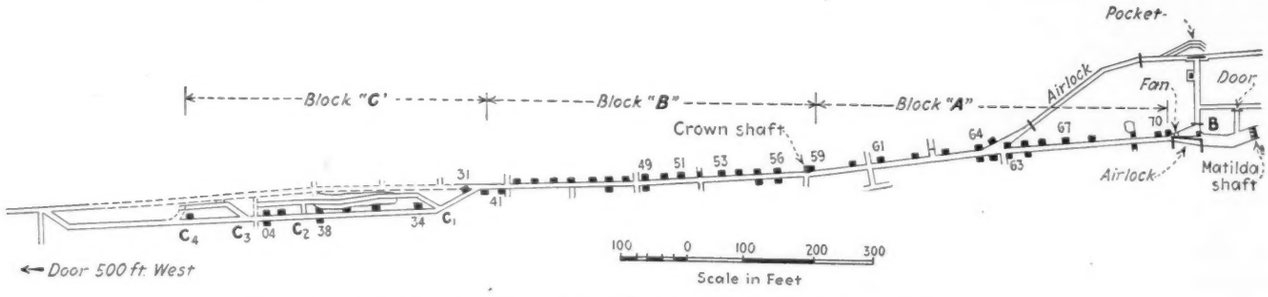


Fig. 5—Plan of a portion of the 700 level—During mining operations

While this work was in progress, the fire broke out behind us at the Crown Reef shaft. It happened that some months previous, when the fire was burning near this shaft at the 600 level (it was caved above this level), as a safety precaution a concrete bulkhead had been built across this shaft at a convenient point below the 600 level. Notwithstanding all our precautions, the fire got through and filled the 700 level full of caved hot rock and burning charcoal. Water was immediately played on the pile and kept on it until the mass was spiled through and sealed off with plastered bulkheads. After this was accomplished, portholes had to be cut in the bulkheads and water played on the partially burned embers and hot rock, which kept smouldering for a long time. We were favored by having a good supply of air from the fan, and the work being on the windward side of the fire, the men could work right up against it; in fact, many times the spiling or the set being worked on would catch fire. The air supply allowed the workmen to get at it immediately and keep it smothered with water. With this danger obviated, the haulage tunnel was again opened, and the preparation of block C continued. The method of mining block C was by way of the haulage drift (7 ft. x 7 ft. 6 in.). through the center of the vein for the entire length of the block. Pony sets 5 ft. high were set on top of the haulage sets for the entire length; these were angle-braced to better enable them to support the ore that was to be broken on top of them. Short inclined drawing-off holes were then run up on each side of these pony sets, and the vein was undercut for the entire

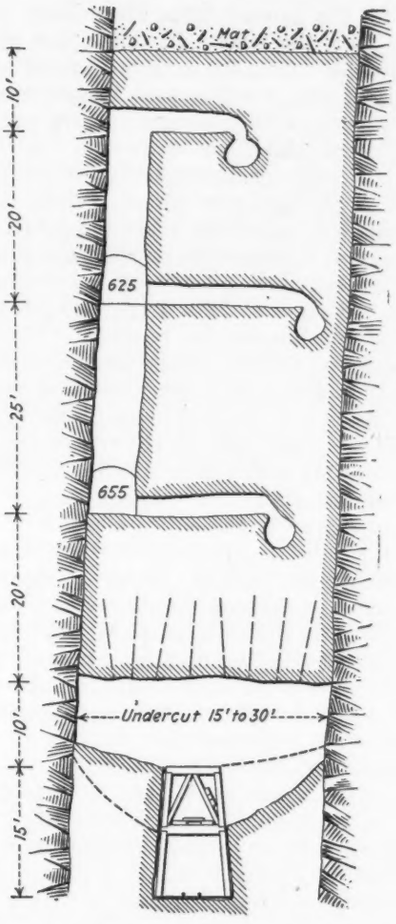


Fig. 6—Ideal section showing method of block caving

width and length of the stope. The back was then drilled with stoper holes about 10 ft. in depth and shot down. Access to the stope during this procedure was had through the drawing-off holes, but after the block was shot down, all the entrances were closed. In the meantime, small crosscuts were run, about 25 ft. apart, across the vein on the 655 level, 45 ft. above. From these crosscuts, small chambers or "bugholes" (See Fig. 6) were sunk at various places and loaded with four or five boxes of 40 per cent powder, the amount of powder used being determined according to the burden and the hardness of the ore. These holes, when blasted, broke down the remainder of the ore *en masse*. The excess of broken ore had, in the meantime, been drawn off sufficiently to allow for the expansion of the ore shot down by the "bugholes." Drawing off was again resumed and continued until the stope was drawn empty, or until the waste and old timber began to show from the mat above the 655 level, which, as a rule, settled on the receding ore.

The block was about 450 ft. long and was cut into 50-ft. stopes. While we were drawing off from one stope, the adjoining stope was being prepared. Progressing in this manner until the entire block was finished, a duty of 7.85 tons per man was obtained in stoping and an extraction of 93 per cent of estimated tonnage; 83 per cent extraction of copper was made.

The stoping of block B required slight changes in the method of mining (Fig. 6), owing to the increased height of the block. To begin with, the haulage level was in the right place, it being near the center of the vein for the entire distance. The pony set posts on top were made 6 ft. high to give more head room, and the necessary manways were driven from the 700 to within a short distance of the 600. These manways were not driven through to the 600, in view of the fact that we did not care to chance breaking into the fire area above, and so release the air pressure that we were trying to maintain in the stopes.

The stoping operations from the 700 to the 655 were carried on much the same as in block C. From the 655 to the 600, a sublevel, called 625, was driven along the hanging wall halfway between the two levels, and raises were driven 25 ft. apart to within 10 ft. of the 600 level. "Bugholes," driven from the top of these to the vein, were placed directly underneath on the 625 and 655 levels.

The method of firing and drawing off was as follows: The vein was undercut over the pony sets on the 700 level and 10-ft. stoper holes were drilled in the back and fired. Some of the ore was drawn off to make room for the expansion of ore to be broken down by the "bugholes," which were then shot on the 655 level. This usually filled everything up to the back of the level. Considerably more ore was then drawn off to make room for the expansion of ore to be broken down by the "bugholes" on the 625 and from the raises above. This completed the operation. Drawing off of the ore was then resumed and continued until the stope was empty of ore. The block was about 500 ft. long, and was cut into 50-ft. sections.

Severe Working Conditions

Difficulty was encountered at various stages in the mining of this block, owing to the fact that we were passing under the active fire area. Beginning at No. 49 stope and extending east to No. 57 stope, the heat increased so much in the top sublevel that we usually obtained a temperature of 110 deg. and humidity as high as 100. Under these conditions it was impossible to expect efficiency from the workmen. Also, at this point we were getting near the danger line of premature explosion of powder in the holes.

We tried various schemes of bratticing in an endeavor to increase the air current at these particular places, but owing to the fact that the fan had such a large area to supply, by the time the air reached the top levels it was too much dissipated to have much cooling effect in such high temperatures. Therefore it became necessary to resort to auxiliary ventilation. This was done by placing a No. 4 Sturtevant blower, direct-connected to a 2.5-hp. motor, in the pony sets, over the haulage level. The blower was installed near a manway and 8-in. flexoid tubing was connected and carried up the manway and into the working place. This quickly reduced the temperature to normal; the method was continued until we got away from the heated area. Difficulty was encountered in handling the hot ore in the drawing-off holes. Imagine working all day around ore that was so hot that it could not be picked up. This was the situation around stopes Nos. 53 and 54. The hot ore had to be kept moving to prevent the timbers in the drawing-off holes from burning. A spray of water had to be constantly played on both ore and timbers, and even with this precaution the pony-set timbers caught fire many times. The water hose was brought into service at full capacity. Even the cars

had to have an occasional drenching to cool them off. Dust was a troublesome factor in the burnt areas during some stages of the operations.

At the drawing-off holes especially the dust was exasperatingly irritating to the throat and nostrils. Respirators were worn and various methods of spraying tried, but without satisfaction, until we finally installed a Sturtevant blower similar to the one previously described. This produced a sufficient blast of air to clear the dust away and allowed the men to work on the windward side of the drawing-off hole, but the working area beyond was limited. However, there was little of this to do, as we were retreating toward the fan and taking everything down to the level. As before stated, part of this block was under the active fire area, thus necessitating working and watching at the same time. The men were always on the alert for fire, gas, and air blasts; and it was necessary to confine our operations to a small area. But despite mishaps, the result was a production of 13.12 tons per man, attained in stoping, an extraction of 93 per cent of the estimated tonnage, with 83 per cent extraction of copper.

While the work in block B was in progress, the third fire was discovered in block C near No. 34 chute on the 700 level. The mat being directly above the haulage sets, the fire soon reached it and could not be extinguished. The mat being continuous to the eastward, the fire, following the air, spread rapidly. A large amount of bulkheading was done to keep the 700 level open as a second entrance to the mine, until a new manway could be driven from the 1,100. When this manway was completed, the 700 was sealed off at the old water bulkhead, and the fire was permitted to burn. This would not be detrimental to future operations, as there were no connections to the 800 level from the 700.

Shrinkage Stoping Adopted

In mining block A it was advisable that we again change our mining method, in consequence of the fact that the horizon ranged from 150 to 200 ft. in height. Also the vein was erratic in width, with a range from 8 to 40 ft. We decided to change to the shrinkage method, for with a width as narrow as 8 ft. block caving would be impracticable. A pillar 40 ft. wide was left at the west end of the block further to safeguard us against fire and air blasts, for we well knew that we were near an active fire around the Crown Reef shaft. This pillar contained a manway (called No. 59) up its center as far as the 625 level. Break-throughs at 17-ft. intervals provided entrance into the stope, and likewise provided entrances at the finishing up of block B. The entrances from this manway into block B were later sealed and bulkheaded as they were open into the active fire area. Pony sets were placed on top of the haulage sets as far east as No. 63 chute, which was the end of the narrow portion of the vein. This left a stope about 200 ft. long, which was worked by shrinkage to the top of the ore.

When this was finished and ready to draw, we returned to the pillar at No. 59, and undercut it at 17-ft. intervals, drilling long holes in both top and bottom and caving it. The pillar and shrinkage stope were then drawn together. From No. 63 chute east, the vein widened considerably, and, being more siliceous, was much harder. Desiring to keep the haulage level open in this section for future use, the placing of pony sets over the top and mining out the ground immediately over the sets, as in previous operations, had to be abandoned. The 655 level was taken as our drawing-off level, leaving the ground from there down to the 700 as a pillar over the level. In this pillar raises were run up to the 655; from these raises, immediately above the chute doors, finger raises were run off and extended up to the 655 level, with crosscuts to correspond. Drawing chutes were placed on each side, to the stopes, which were commenced immediately overhead.

The system of stoping employed in this section was what is commonly called the room-and-pillar. A pillar 25 ft. in length and as wide as the vein was left between each room. The length of the rooms varying from 40 to 160 ft.; manways were carried up in each pillar, with entrances into the rooms at 17-ft. intervals. These were later undercut, drilled over, top and bottom, blasted, and drawn at the same time the rooms were drawn. This method proved successful. The stopes varied in height from 100 to 150 ft.; in stoping this block 14.52 tons per man was obtained, with 100 per cent extraction of the estimated tonnage and 89 per cent extraction of copper in the entire block.

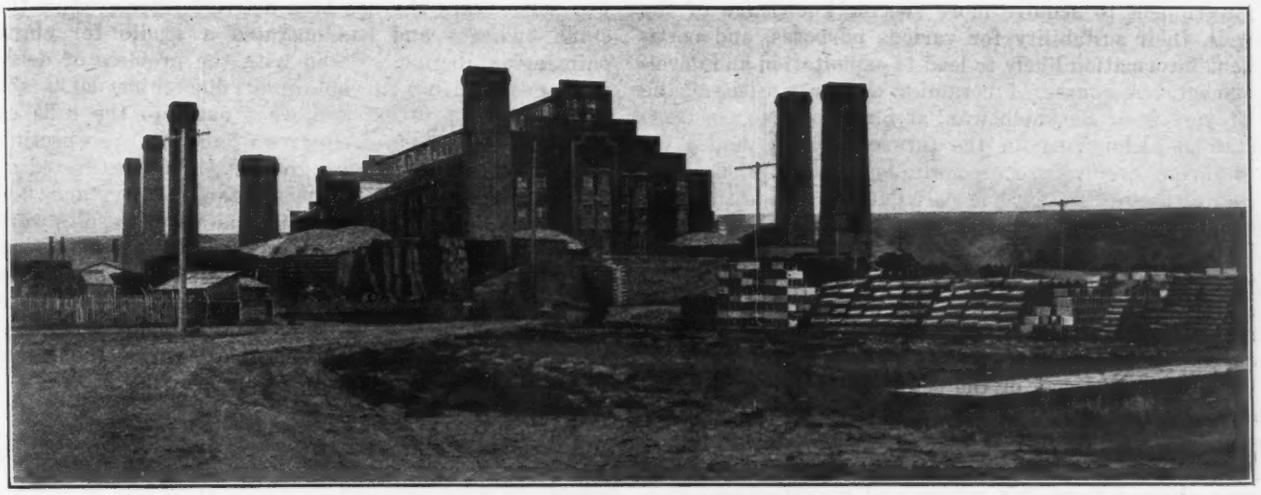
During the mining of block A little trouble was caused by either fire or gas. However, we were occasionally obliged to contend with horses or tongues of waste that cut into the vein from the top, usually causing a split in the vein and making it necessary to leave the waste and follow the split fragments of vein. This delayed the schedule and caused extra connections to be made, which were necessary for entrance to the stope and for prospecting the limits of the ore.

The mining of blocks A, B, and C extended over a period of two years, during which time 189,517 tons of ore was mined, with an average extraction of the estimated tonnage of 97 per cent; 86 per cent of the estimated copper was recovered and 12.5 tons per man was mined.

The ore estimates having been made prior to the fire, the low extraction may be partly accounted for by the action of the water at the time of the flooding, assisted by the heat from the fire, which would naturally cause considerable leaching to take place. Taking into consideration the fact that most of the ground had already been prepared for slicing, thereby causing a large number of faces to be exposed to the action of the water, considerable leaching was to be expected. Preparations were made to draw the water off slowly and precipitate the leached copper as the water flowed out, but, as the water broke out around one of the bulkheads and could not be controlled much copper was lost. Great credit is due to the foremen, John Martin and W. J. Williams, and to the shift bosses, Z. W. Wilson and Alexander D. McLean, for the efficient and painstaking manner in which the work was carried on.

The Weight of Sand

Fine sand, says a writer in *Rock Products*, usually weighs about 2,500 lb. to the cubic yard, or 92½ lb. per cubic foot. Good concrete sand will run much higher, 110 lb. to the cubic foot perhaps. It is stated by one authority that good concrete sand should have a specific gravity of at least 1.65, which would mean a weight of 103 lb. to the cubic foot. These are dry weights, but sand is always sold in a moist condition, which would make the weight per foot more if one had to use it in designing a bin, for example. The heaviest sand noted was a washed sand from a pit in New York State. In the ordinary moist condition it weighed 135 lb. to the cubic foot and it made an excellent concrete sand.



Plant of the Alberta Clay Products Co. at Medicine Hat.

Clay Industry in Saskatchewan

Canada Has Heretofore Imported Clay Products—Domestic Deposits Being Developed—Outlook Good

BY E. L. CHICANOT

THE CLAY-PRODUCTS industry of Canada is as yet an infant; it is unable to furnish even the domestic market adequately, but it possesses potentialities of a future lusty and thriving industry, with the probability of its outstripping many activities which are already considered important in the dominion. The industry to day is healthy and expanding; it has been built up on deposits of comparatively small size and value, and attention is only beginning to be directed to some of Canada's largest and richest deposits of clay. Among these are deposits in the southern part of the Province of Saskatchewan.

The total value of the domestic clay products marketed in Canada in 1921 was $8,335,900, and though this shows a decline from the previous year's value of $10,523,271, this is attributable entirely to the declining unit prices, as a substantial increase in the output was achieved.

IMPORTS LARGE

Canada's imports of clay and clay products in the last year amounted in value to $6,778,365, in which total unmanufactured clay was represented by $344,280. Total imports in the previous year, when higher prices prevailed, amounted in value to nearly $11,000,000, and in the one preceding that exceeded $6,000,000. The dominion's imported manufactured products of this nature comprise practically every manner of article made of clay. Of the total value of these, amounting to about $6,500,000, one-half was supplied by the United Kingdom, and slightly less was brought in from the United States.

EXPORTS HAVE BEEN NEGLIGIBLE

It is apparent that, granted that Canada possesses the sources of raw material in sufficient volume, the industry is one of promise, having regard only to the domestic market and disregarding the possibilities of an export business.

The centers about which the Canadian clay-products industry revolves at the present time are St. John, in New Brunswick; St. Johns, in Quebec; and Medicine Hat, in Alberta. Of the three the western industry, which was the latest to be established, has, under aggressive management and with the aid afforded by favorable economic conditions, forged ahead until it accounts for 75 per cent of the dominion output. The product from Alberta has penetrated the eastern field in Canada to an extent and has also found a market in the United States.

Knowledge of Canada's clay resources has not heretofore been extensive or accurate. It has been generally known that the dominion was in the fortunate possession of valuable but scattered deposits. These consist of fire clay, brick and tile clays, and earthenware clays. Fire clay is known to occur in certain parts of Nova Scotia and in southern Saskatchewan, as well as in British Columbia. It has been found on two rivers in northern Ontario and on the Athabasca River in northern Alberta. Semi-refractory clays had been found in Nova Scotia, New Brunswick and several points in southern Saskatchewan. Brick and tile clays occur all over Canada and overwhelmingly so in Ontario. Earthenware clays occur in southern Saskatchewan and Nova Scotia.

COAL AND NATURAL GAS HELPFUL FACTOR

Southern Saskatchewan seems to be favored in regard to a variety of clay deposits, and for some time attention has been directed to a wide area along the railway line running from Weyburn to Lethbridge. Basing their forecasts on the nature of the clays of this field, the convenient situation as regards transportation and markets, those who are familiar with conditions predict that Saskatchewan will eventually assume an important position in the dominion, based on industries utilizing clays, coals, and natural gas.

The fullest preparation has been made for such development. Steps have been taken by the provincial

government to acquire more specific knowledge of the beds, their suitability for various purposes, and pertinent information likely to lead to exploitation and development. A course of ceramics was instituted at the University of Saskatchewan, at Saskatoon, to ensure a staff of technicians for the future industry, and a ceramic engineer was secured who had a wide practical as well as theoretical experience. Private prospecting has supplemented government efforts, and today trustworthy information on the Saskatchewan clay deposits is extensive and encouraging.

So far the surveys carried out by the province's ceramic engineer have resulted in concentrating attention on the deposits in the Readlyn-Willows and Eastend-Ravenscrag districts of the southern area of the province. Surveys have disclosed large deposits of good clay in these localities. Clays of a wide range of physical properties are present and many carloads have been shipped from this region and manufactured into creditable lines of crockery and stoneware at Medicine Hat, Alberta.

Excellent Material for Granite Ware

In the Readlyn-Willows district the clays have been found to be of the ball or semi-ball types, burning nearly white. In some cases a creamy white burning clay was found much lighter than similar commercial clays in

Deposit of stoneware clay near Knollys, Saskatchewan.

Great Britain and the United States. These clays should form the basis for the manufacture of such products as granite-ware, floor and wall tile, insulators, and similar ware where a white body is desired. There are also to be found in this district clays of the stoneware type as well as semi-refractories suitable for sewer pipes, terra-cotta, enamel-ware, and ordinary fire brick and stove linings.

These two Saskatchewan clay deposits are arousing particular interest at the present time owing to the recent completion of the railway from Weyburn, in Saskatchewan to Lethbridge, in Alberta, thus providing the final link in the transportation chain between these points. The deposits, which lie close to the railway line, and not far from the international border, are now provided with fine transportation facilities. In addition the Readlyn-Willows deposit is within relatively short distance of the Souris coal fields. The Eastend-Ravenscrag deposit is well situated in respect to a supply of pure water, and is in close proximity to the great semi-bituminous coal fields of southern Alberta.

A further possible line of Saskatchewan clay development is attributable to the efforts of Miss Helene Pachal, a graduate of the New York School of Ceramics. For some years she has been actively interested in the china business and has operated a studio for china painting in Regina. Faced with the problem of delay and inconvenience in obtaining fine china clay, she undertook to prospect and went out into the hills of Saskatchewan alone. After two summers' prospecting she discovered the long sought clay. Samples tested at Medicine Hat proved eminently satisfactory, and fine china dishes resulted. Similar satisfactory results were obtained at New York. Quantitative tests proved that only 2 per cent of outside materials were needed to supplement the clay to make the finest pottery and table dishes. Other tests proved it could be made into pony insulators for high-voltage electrical wires, thousands of which are imported into Canada every year.

Good Outlook for the Future

Upon a further trip to the hills, extensive excavation operations were undertaken, which, according to report, proved that the clay was a thick deposit extending over a wide area. Miss Pachal believes she has discovered one of the richest clay deposits of its kind in the world, and is engaged at the present time in preparation to exploit the discovery by erecting a plant for the manufacture of dishes and insulators.

The establishment of a clay-products industry in the Province of Saskatchewan can be reasonably expected. Excellent clay deposits of various kinds are available; transportation facilities are good, and supplies of coal and other requisite materials for manufacture are at hand. Further, there is a pressing need for the establishment of such an industry, with a voluminous import trade in clay products which is tending to increase.

Western Fluorspar Industry Holds Little Promise

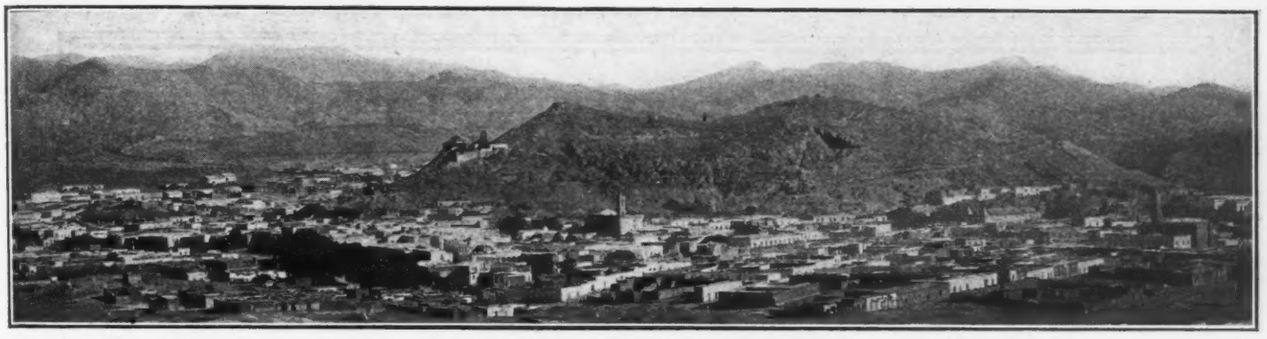
After weighing all evidence afforded by actual examinations of western fluorspar deposits, and by available information from other sources, the following conclusions have been reached by Raymond B. Ladoo, of the U. S. Bureau of Mines:

1. With one exception, all of the deposits worked have been so small, or so far from transportation, or contain fluorspar so mixed with silica or barite or both, that profitable production of *gravel grade* of fluorspar, acceptable to eastern steel mills under present standards, has been impossible, and the future seems no more promising. There are two small mines which would yield a few hundred tons annually by screening hand-picked ore, but from present indications these properties do not justify the erection of mills.

2. With only one exception, the most accessible ore from the mines which have been worked has been removed. The mines are for the most part in poor physical condition, and future operations will be increasingly difficult and expensive.

3. Most of the western mines have long and expensive hauls to railroad, and the orebodies are too small to justify the cost of installing improved methods of transportation, or modern mining and milling equipment.

4. The production of *acid fluorspar* west of the Mississippi River from orebodies now known probably will not exceed 100 tons annually. It is believed that not over 3,000 tons of *ground fluorspar* can be annually produced, of which one-third will be low-grade.



City of Parral, Chihuahua, Mexico

A Romance of Mining in Mexico

BY BERNARD MACDONALD

THE PHOTOGRAPH above presented, of Parral, Chihuahua, is taken looking north over the city, with Cerro de la Cruz (Hill of the Cross) in the immediate background and the distant mountains on the horizon. It is an epitomized illustration of the romance tied up in the mining and political history of Mexico. Parral is an ancient mining camp. The Cerro de la Cruz has been the scene of numerous combats for the possession of the city in the past: it was the key to the city, which was the prize sought by all the opposing parties.

As the position and configuration of this hill were favorable to the strategy of military operations, its geology and position in a highly mineralized mining region might be considered favorable for the strategy of ore deposition; that, in fact, it should be the natural habitat of extensive deposits of pay ore. In confirmation of this deduction, tradition reported that in the old days the mines there had made an important contribution to the output of silver that made the Parral district famous: but that, at the 400-ft. level, Pluto stood guard over the deeper portion of the ore deposits, and said to the Mexican miners, "Thus far and no farther"; and it was so.

The position of the south-side vein is indicated by the open cut visible in the picture, and the large dump shown at the easterly end of the hill is from the north vein. Crossing these veins, and doubtless responsible, in part at least, for the localization of the large ore deposits in them, is a system of small north-south veins, which are barren, except in some cases for a short length at the crossing point.

Theoretically, the deductions merited favorable consideration, but the mines remained idle until, in recent years before the revolution, some of the mines came under the control of American companies, whose efforts at rehabilitation, however, met with failure also, because of ill advice and insufficient capital. These abortive efforts and the military operations, above referred to, fell like a curse over the treasures hidden under Cerro de la Cruz, and the reverberations of the miners' blasts, and the bray of burros, were heard no more in Parral, for years.

During the idle period that followed, the wide-open mouths of the old workings on this hill and the favorable geological formation that inclosed them appealed to the knighthood of the world to come and rescue the hidden treasures. The cry was heard in distant lands, and bold knights, clad in khaki and armed with pick and Brunton, came from afar to inspect the phenomena. But there was no ore "in sight," at least not "blocked out" so that it could be sampled; in fact, there was nothing to be seen but the wide, gaping open stopes as deep as the unaided eye could penetrate from the surface.

In the fullness of time, a young giant, bearing the consolidated name of Asarco, who had been specially trained and equipped for adventure in the Land of the Mañana, came, saw, and conquered. But the victory was not an easy one. In the treaty of capitulation and peace made between the parties it was agreed and stipulated that King Pluto, the party of the first part, was to surrender all the treasure he had so long and effectively guarded underneath el Cerro de la Cruz, to be used and enjoyed by the young giant, the party of the second part, his heirs and assigns forever, with the contingent obligation, however, that the said second party should transfer from the mine workings to the Parral River 3,000 gallons of water 1,440 times every day.

Since the execution of this treaty its terms have been faithfully observed by both parties. The party of the first part furnishes the full stipulated measure of water with distressing regularity, and the second party transfers the amount with equal regularity to the Parral River, as provided.

Incidentally, daily trains carry the sparkling ore wrested from the once mythical hoard lying buried under the ramparts of el Cerro de la Cruz to the works with the tall chimneys at Chihuahua City, for treatment, and thus the substance of things hoped for is realized.

Leaving allegory aside, and using the cold language of the market place, the net returns of the Asarco enterprise, alluded to, are well abreast of, if not greater than, those of any other mining unit owned by the American Smelting & Refining Co. in Mexico.

The emoluments of the enterprise, however, go not alone to the party of the second part; the federal and state governments come in as the party of the third part, and get theirs first; besides, hundreds of workmen, earning higher wages than ever paid in Parral before, are steadily employed.

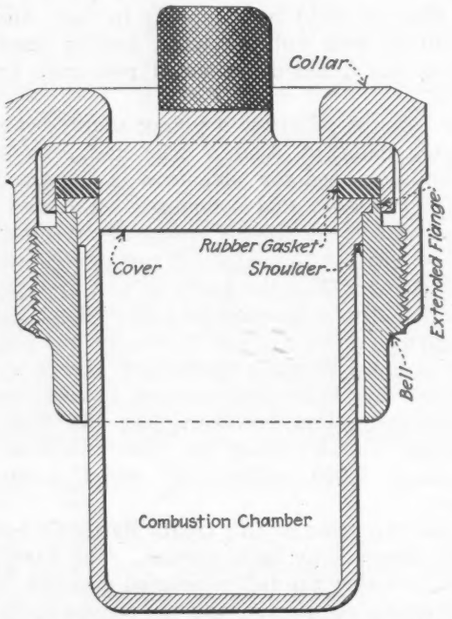
All enjoy peace and prosperity, no one is injured, and a grateful people sing the praises of the young giant that raised the curse that hung for years over the treasure vaults of el Cerro de la Cruz.

USEFUL OPERATING IDEAS

Method for Determining Zinc and Lead in Materials Containing Large Amounts of Carbon

BY WILLIAM KAHLBAUM
Research Metallurgist and Chemist, State Mining Experiment Station, Rolla, Mo.

During some experimental work on the distillation of complex lead-silver-zinc ores recently carried out by the U. S. Bureau of Mines in co-operation with the State Mining Experiment Station of the Missouri School of Mines and Metallurgy, it was necessary to make numerous determinations of zinc and lead in samples of ore



Combustion bomb used in determination

briquets containing about 35 per cent of finely divided coke and 13 per cent of coal tar pitch; also, in samples of the residues from these briquets after the volatile hydrocarbons and most of the zinc had been distilled from them. It was found to be impossible to get satisfactorily accurate determinations of zinc and lead in this material after ordinary acid decomposition, as the carbonaceous substances could not be oxidized completely enough to prevent their interfering with the analysis.

It was not feasible to burn off the carbon in the ordinary way, by heating in air, because of the danger of reduction and volatilization of part of the zinc and lead. To accomplish this oxidation of carbon without loss of zinc the method described below was developed. It has been used for several hundred determinations and has given entirely satisfactory results. It has since also been used for the determination of zinc and lead in the residues produced in the ordinary retort process for the distillation of zinc ores and has proved to be a rapid and accurate method for this purpose.

The device used for the combustion of the carbon is an adaptation of Parr's combustion bomb[1] commonly used for the determination of sulphur in coal. It is illustrated in the accompanying drawing. The bomb used for sulphur determinations is usually made of nickel steel, but as nickel would interfere with the determination of zinc, it was necessary for this determination to use a combustion chamber and cover made of plain carbon steel (the steel used contained 0.20 per cent carbon). Otherwise the bomb was exactly as furnished for sulphur determinations.

The material for the analysis of which the method was developed was inclined to segregate after grinding, and to get satisfactory samples it was necessary to grind the pulp to pass a 200-mesh screen, but if the pulp is uniform it need only be ground to pass a 100-mesh screen.

Place 0.5 or 1 g. of the sample in the combustion chamber and add 5 or 10 g. of sodium peroxide.[2] The amount of sodium peroxide necessary to give a good fusion varies somewhat with the nature of the sample, and in analyzing unfamiliar material a preliminary trial or two may be necessary to determine the correct proportion of peroxide. If the sample contains no volatile hydrocarbons, a small pinch of 100-mesh coal tar pitch added to the mixture will aid in securing complete combustion of the carbon.

Now assemble the bomb and screw the lid down tightly. Mix the charge by shaking the bomb vigorously and tap the charge down into the bottom of the combustion chamber. Place the bomb in a hole cut in a sheet of asbestos, with the bottom half of the combustion chamber projecting below the asbestos. Place a blast lamp so that the flame surrounds this bottom portion of the combustion chamber. The heat of this flame will soon cause the charge inside the bomb to ignite, and the combustion of the charge will be indicated by a sudden glowing of the combustion chamber, which lasts only a few seconds. The oxidation of the carbon is complete, and there is no opportunity for loss of zinc or lead, as the bomb is absolutely gas tight.

As soon as the combustion of the charge has taken place, and before the upper part of the bomb has become hot enough to injure the rubber gasket, remove the bomb from the flame and cool in a stream of water. After allowing the bomb to stand for a few minutes, take it apart and place the combustion chamber with its cover in a 400-c.c. beaker and cover with a watch glass. Leach out the fusion with a little distilled water, and wash out the combustion chamber and cover with distilled water, using a policeman to insure complete removal of the fusion. The solution is not, of course, complete, but the insoluble hydroxides will go into solution with the subsequent acidification with hydrochloric

[1] U. S. Pat. 1,136,361.

[2] Potassium chlorate is also added to the charge in the determination of sulphur in coal, but its use in the determination of zinc introduces complications because of the effect of undecomposed chlorate on the titration of zinc with potassium ferrocyanide, so that it is better to omit it.

or nitric acid. Separate samples should be fused for the zinc and lead determinations, but the procedure is the same for both up to this point.

To determine zinc, acidify the solution of the fusion with hydrochloric acid and add a few cubic centimeters in excess. If the combustion and fusion have been correctly made, this should give a clear solution containing no particles of carbon. Boil the acidified solution for a few minutes, add 5 g. of ammonium chloride, 20 c.c. of ammonium hydroxide and 2 or 3 c.c. of hydrogen peroxide. Boil, filter and wash with hot ammonium chloride solution. Redissolve and reprecipitate the iron and manganese, combine the filtrates and washings, and determine the zinc by any of the usually accepted procedures for the determination of zinc by titration with potassium ferrocyanide in acid solution.

To determine lead, acidify the water solution of the fusion with nitric acid. If the sample contains over 5 per cent lead, add 20 c.c. of concentrated sulphuric acid and evaproate to copious fumes of sulphur trioxide. Take up with distilled water, dilute to 200 c.c. and boil. Cool, filter off the lead sulphate, and determine the lead by the usual molybdate method.

If the sample contains less than 5 per cent lead, the nitric-acid solution may be electrolyzed and the lead determined according to the usual procedure for the determination of lead by an electrolytic method.

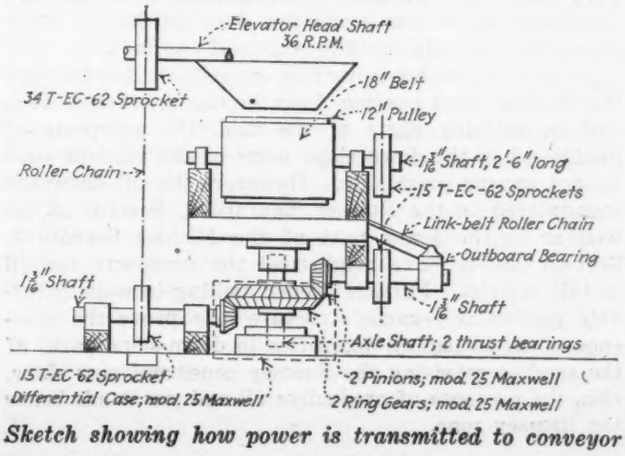
Pivoted Belt Conveyor of Automobile Parts

BY R. F. MUNDORFF

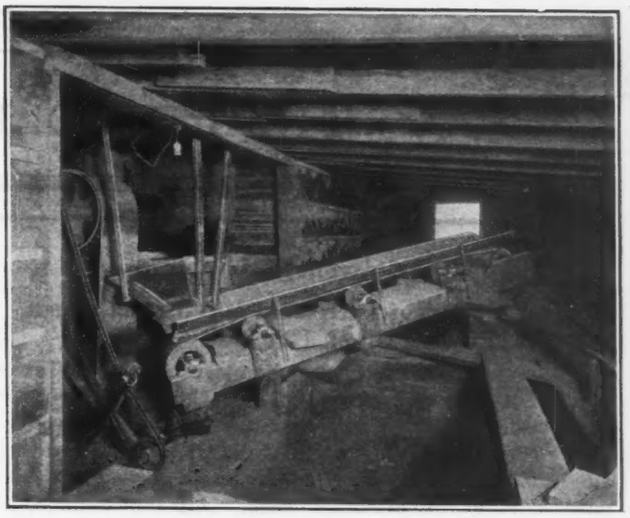
A stone-crushing plant situated in the business district of Kansas City where dust is a nuisance required a conveyor for distributing the crushed product to the bins. The conveyor had to be as low as possible to minimize the cost of inclosing it. Because of this it was impossible to make it high enough to chute the stone directly to the bins.

The screen and initial bins formed one section of the plant, and the loading bins, forming the other section, were built considerably higher, with chutes from the initial bins leading to a bucket elevator which raises the stone to the top of the loading bins. Here a short swinging conveyor made of automobile parts was installed to distribute the material to any one of the three loading bins, merely by swinging the conveyor about the axis on which it is pivoted.

An elevator discharges into a hopper at the fixed end of the conveyor and the belt carries the material to the desired bins. The belt is on a framework which swings through an arc of about 90 deg. on a track of channel iron bent to a 9-ft. radius. The support can be swung



Sketch showing how power is transmitted to conveyor



Home-made swinging belt conveyor

around to any bin very easily. The swinging is accomplished without affecting the drive of the belt by the adaptation of the ring gears, pinions, and differential case from two automobiles.

A 5-hp. motor which drives the elevator through a gear-reduction unit also drives the belt by means of a roller chain on a sprocket from the elevator head shaft, to a shaft below the belt, through the pinions and ring gears and another shaft with roller chain driving the shaft of the belt from the rear end.

The diagram shows how this power transmission is accomplished without affecting the ability of the belt to be swung around as desired. The adaptation of the old automobile parts was made by Gilbert V. Bradbury, who designed the conveyor for the E. H. Bradbury Contracting Co. of Kansas City, Mo.

Odds and Ends in Erecting

BY CHARLES LABBE

Four odd things worth mentioning happened to me in mill construction. One was the breaking of long truss rods, caused by vibration and the resulting crystallization. They were replaced by a wire cable of the same size and no more trouble was experienced.

In a large framework, tightening rods over 20 ft. long were to be put in place, but as they were of just the right length when in position, they could not be used for drawing up. Enough bolts 24 in. long were assembled by coupling them together with short pieces of pipe to make the required length. Two bolts were run through each piece of pipe in opposite directions. This permitted the timbers to be drawn together. Then the bolts were removed and the right rods put in their proper place.

In mill work where finish and looks in out of the way places are of secondary consideration it is better to place square nuts with the sharp corners out (the beveled side to be on the washer). This gives a better bearing on the washer, the nuts are easier to turn and there is less chance of the wrench slipping in tightening up.

When a turnbuckle with right- and left-hand threads is needed and cannot be obtained, two eyebolts or two common bolts with right-hand threads can be used if a piece of pipe about 6 in. long is slipped over the end of the bolts, and washers are used under the nuts to permit easy turning with a wrench.

THE PETROLEUM INDUSTRY

Corsicana-Powell Field Expanding

Texas Output of Petroleum May Increase as a Result—Oil on University Land

The development of major interest in the Texas petroleum industry recently is the rapid expansion of the Corsicana-Powell field and the increase in production. During the week ended June 27 the output averaged 29,425 bbl. per day, as compared with 9,125 bbl. daily during the previous week. All the wells completed are large producers. This and other new developments in north and central Texas may tend to increase the total production of the state, which declined to 23,561,183 bbl. during the first quarter of 1923 from 26,267,740 bbl. during the last quarter of 1922. In North Texas the action of the Texas Company in not accepting additional spot deliveries of crude oil, following the prorating of runs by the big oil-purchasing companies, has left a considerable production of oil without a market.

A discovery of great interest to Texas University is the completion of a good wildcat oil well in Regan County, in the center of a large acreage of university land. If this area proves to be an oil field, it bids fair to make the University of Texas one of the richest educational institutions in the world.

Deep oil has been proved in two more fields recently, at Ivan, Stephens County, and in the Currie pool. At Ivan, the Texas Company has drilled two wells to oil in the deep lime at 3,930 ft. and 3,953 ft. At Currie, the Republic Production Co. has completed a 300-bbl. well at 3,875 ft. at the south end of the pool. This is 600 ft. deeper than other producing wells of this field.

New Gas Field Discovered in Illinois

The Goag Oil & Gas Co., of New York, under the management of H. A. Wheeler, of St. Louis, has just opened up a new natural-gas field near Gillespie, in Macoupin County, Ill. The discovery well came in with a production of 5,000,000 cu.ft. per day at a pressure of 155 lb. at a depth of 540 ft. The gas sand is in the Lower Coal Measures and is 200 ft. below the No. 6 coal vein that is extensively worked in this part of Illinois. In fact, it underlies the No. 1 mine of the Superior Coal Co., one of the largest producers in the state, with a daily output of 4,500 tons. An important protracted lawsuit resulted from the fact that the leases of the Goag company largely occur amid the workings of this mine that the local court ruled could not be drilled through. On carrying the case to the Federal Court, the rights of the Goag company were maintained, in harmony with the decisions in the Pennsylvania courts.

The field occurs on a strong dome along which the Goag company has a large acreage. Among the stockholders are some of the leading mining engineers of New York, including Pope Yeatman, J. Parke Channing and Harris Hammond.

Oil Possibilities of Chickasha District

Prospects for Discovery Improve as Drilling Deepens in Some Sections

Several wells are now being drilled for the purpose of testing the oil possibilities of the Chickasha field, in Grady County, Oklahoma, about 50 miles southwest of Oklahoma City, according to the report on the field by M. J. Kirwan and T. E. Swigart, recently issued by the U. S. Bureau of Mines. Some of these wells are drilling below the Nichlos sand horizon and have reported sands which showed oil. In addition to the Ramsey Sandford 1, Section 23-5-8, the Nichlos Serrato 1, Section 25-5-8, and the Magnolia Dahl 1, Section 22-5-8, the Magnolia Irvin 1, Section 14-5-8, is being drilled as a deep test in the north end of the field. Among other deep tests now being drilled are Magnolia Kearns 1, Section 23-4-8, and Ramsey 1, Section 10-4-8, in the southern part of the field.

Sinclair Williams 2, Section 11-4-8, also in the southern part of the field, set casing above the Nichlos sand at 1,440 ft. The Nichlos sand produced a small volume of gas and also carried water. The well was continued with rotary tools as a deep test. A number of sands were found between the Nichlos sand and the present depth of about 2,200 ft., which "showed" oil and gas. On April 26, without setting additional casing below the Nichlos sand horizon, which as mentioned carried water and gas, the open hole was bailed and the well "blew in" at an estimated open flow volume of 25,000,000 cu.ft. per day. This well is interesting in that it indicates the presence of a productive gas zone below the Nichlos sand in the southern part of the field, which probably is the equivalent of the Ramsey sand in the northern part of the field. Until casing is set to exclude water, no accurate test can be had.

The Atlantic Doss 1, Section 30, T. 5 N., R. 7 W., and the Snowden and McSweeney, Glover 1, Section 6, T. 4 N., R. 7 W., in the eastern part of the field, were recently abandoned as dry holes. Arrasmith and others reported oil sand in their wells 1 and 2 in Section 19, T. 5 N., R. 7 W., at about 1,900 ft. Both these wells were abondoned because of mechanical troubles. No important oil or gas showings were logged in other abandoned wells in outlying parts of the field.

In view of the large number of wells drilled through the Nichlos sand horizon, both in the productive area and in outlying parts of the field, the prospects of finding oil in the down slope parts of the Nichlos sand do not appear promising. However, the oil showings encountered in the Ramsey Sanford 1, Section 23, as well as in the lower part of the Nichlos Serrato 1, Section 25-5-8, have brightened the prospects for oil in this district. Further deeper drilling in wells favorably located as regards structure may prove the presence of oil in paying quantities in down-slope parts of the sands comprising the Ramsey zone, and may show, also, the presence of productive oil and gas sands below the Ramsey zone.

CONSULTATION

The Flotation Process and Minerals Separation Patents

"As a subscriber, we would appreciate advice regarding date of termination of the Minerals Separation Corporation patent for its flotation process, and also any other information regarding this patent which would interest us in view of its termination."

The principal Minerals Separation patent is No. 835,120, dated Nov. 6, 1906. This is the patent on which most of the litigation that has so far taken place has been based. This will, of course, under the seventeen-year rule, expire on Nov. 6, 1923. The terms of this patent are given in full in "The Flotation Process," by Megraw, pages 17 to 23. Probably the second most important patent that is controlled by the Minerals Separation company is No. 962,678, granted April 30, 1909. This is commonly known as the "Soluble Frothing Agent Patent." This will expire on April 30, 1926, and its scope has never yet been determined by the courts, so that it is a controversial question whether the Callow cell is an infringement or not when, for example, using such a flotation agent as naphthylamine.

A large number of other patents are also controlled by the Minerals Separation company, and where the flotation at any one plant follows the best and most up-to-date practice, it is likely that some of their patents would be infringed. Just how far one could go after November of this year without infringing the M. S. patents is a difficult question to decide, depending upon the flow sheet of the plant in question, and would have to be determined by competent legal and metallurgical authorities.

It should be borne in mind that the licensees of the Minerals Separation company have the benefit of its advice and of any future improvement which may be covered by patents obtained by or assigned to that corporation.

The Treatment of Colemanite for Borax

"I have a deposit of colemanite, containing borax, in the West, and would like to become posted on the method used in refining and producing borax from this mineral. Can you refer me to any books or articles on the subject?"

The literature on this subject seems particularly scanty, and no articles describing the processes used, in any detail, have been published in the last ten years, to our knowledge. The borates are calcined at the mine and treated for the purpose of eliminating impurities such as pandermite, clay, and water. The calcination dehydrates the colemanite and yields a fine powder which is easily screened from the pandermite and clay. The colemanite is then converted into borax by boiling it with a solution of soda, forming insoluble calcium carbonate and a solution of borax. The borax solution is then filtered, and, on cooling, the borax crystallizes out. The process does not appear to be one of great complexity, and enormous deposits of colemanite are known to exist.

The Barytes Market in the West

"I am taking the liberty of asking for a little information regarding the commercial possibilities of barytes on the Pacific Coast. I note in your price quotations that barytes, 'off color, wet ground' is quoted f.o.b. plant. Does this apply to all other grades, or are they bought under other terms? Could you also give me the address of any Pacific Coast firms or dealers requiring a supply of high-grade barytes?"

We understand that this mineral is usually sold f.o.b. mine, although if the mine were far from the point of consumption it might make the quotation more acceptable to make the price on a delivered basis. A large part of the barytes produced in this country comes from either Missouri or Georgia, with Tennessee probably ranking third. A small quantity is produced in California. Practically all of the barytes, however, is used in Pennsylvania, New Jersey, Delaware and New York, so that producers who are far away from these states receive a proportionately small price for their product, f.o.b. mine. The principal uses, as you no doubt know, are in the manufacture of ground barytes, lithopone, and other barium chemicals. A great deal is used in paint. The demand is now quite active.

We do not know of any western firms that make a specialty of handling this mineral, but suggest that you write to the Barbour Chemical Works, 354 Pine St., San Francisco, Calif., and Lewis, Gilman & Moore, San Francisco. You might also get in touch with the Western Rock Products Co., which has a small mine in California and also, we believe, a mill in San Francisco, which address will no doubt reach them.

The Price of Obsidian

"Can you give me some idea of what obsidian or volcanic glass is worth on the New York market at present? Also, is the American Gem & Pearl Co., of 6 West 48th St., New York, a reliable firm to deal with? I have a deposit of obsidian, and they are in the market for some, but would like some outside opinion as to price."

We understand that the price of obsidian varies from $10 to $30 per ton delivered in the East, depending upon the quality. It would be necessary for you to send samples to prospective purchasers. The American Gem & Pearl Co. is a well-established concern, and, so far as we know, of good reputation.

Solubility of Platinum in Cyanide

"Can you call forth a discussion in your columns on the subject of the solubility of platinum along with gold and silver in cyanide solutions?"

So far as we know, platinum is not soluble in cyanide solution and there the matter ends. We have never heard of any of the metal being found in the bullion from a cyanide plant and do not remember having read anything bearing on the matter. If there is anything to be said on this subject we should be glad to have the comments of our readers.

Recent Technical Publications

Reviews, Abstracts, and References

The Preparation of Metals

Metals and Their Alloys. By Charles Vickers. Henry Carey Baird & Co., Inc., New York. Price, $7.50.

Although this book is based on Brannt's "Metallic Alloys," Mr. Vickers has good reason for publishing it under a different name, for so much of the material is new. So often new editions are published with only the change of a line here or there that many possible buyers are inclined to think the older edition just about as good. We can recall once being solicited to buy a general medical book "the final, last, and complete edition, with everything brought up to date," when, as a matter of fact, practically the entire book had been set up some thirty years before, with the exception of one page, which was lacking a number and told about appendicitis. Owners of the third edition of "Metallic Alloys" need have no fear of an undesirable duplicate in their library by possessing the book under review. The methods of manufacture and uses of metals have been greatly amplified in the last few years, and the number of available alloys greatly enlarged, so that the author had plenty of material to work with and has done his job well. Of course, in a general reference book of the scope of this one, we must not expect a complete discussion of any one subject. No one man has even a reasonably complete knowledge of all the topics covered. Mr. Vickers evidently is most at home in the practical side of brass and bronze founding, and he has relied on other up-to-date published data which has heretofore been scattered, for much of the matter having to do with other subjects.

The scope of the book may be indicated by excerpts from some of the chapter headings: History, production, methods, properties, and uses of the elements; characteristics of alloys and the art of alloying; copper and its alloys; aluminum and its alloys; bell-metal and bridge alloys; brasses and bronzes; railroad alloys; nickel alloys and monel metal; tin, lead, mercury, precious metal, cadmium, bismuth, iron, and magnesium alloys; die castings; solder; surface coloring of alloys; foundry utilization of scrap metals; foundry data; and analysis of babbitt metals. The last mentioned topic is the only attention that is paid to the subject of chemical analysis. There is also not much in the book that is concerned with iron and steel.

Though chiefly of use to the man that takes the metal from our smelters and refineries and prepares it for the ultimate consumer, this book will interest many in the mining industry as indicating what is being done to promote a greater consumption of metals; it will also be valuable to the ultimate consumer in suggesting other metals or alloys that might be superior to those he is now using. Also, a knowledge of all the properties and uses of anything, and an understanding of how it is made, will assist in the more intelligent use of a material, whether it be a special brass alloy, an automobile, or a pound of oleomargarine.

E. H. ROBIE.

French and German Volumes

Cours d'Exploitation des Mines. By L. E. Gruner, Librairie de L'Enseignement Technique, 3 Rue Thénard, Paris. 1922, Vols. IV and V. Price, 25 fr. each volume.

We reviewed the first three volumes of this excellent series on the working of mines, in our issue of Dec. 9, 1922. Now the fourth and fifth volumes are at hand. Vol. IV deals with underground haulage largely; Vol. V with unwatering, ventilation and lighting.

Taschenbuch für Eisenhüttenleute. "Hütte." Akademischen Verein Hütte, E. V., Berlin. Second revised edition. William Ernst & Sohn, Wilhelmstrasse 90, Berlin, W. 66, Germany. Price, $2.60.

This is a thorough revision of the well-known Hütte, the first edition of which was published ten or twelve years ago. It is a comprehensive handbook of almost a thousand pages on the iron and steel industry, including its associated subjects. For those who read German, it is an exceedingly valuable compilation.

Studien über die Kupfererzeugung der Welt. By Dr.-Ing. Moritz Hochschild. Craz & Gerlach, Freiberg, Saxony, Germany. Price, 5s.

This is an interesting descriptive and statistical summary of the copper industry of the world. The text partakes somewhat of the method of treatment followed by the recent monographs of the Imperial Institute in England and "Mineral Resources," issued by our own Geological Survey, but there are in addition almost a hundred pages of tables and statistics, chiefly devoted to production. We know of no compilation of copper-production data that can equal this in completeness. It is, however, not quite up to date, as none of the figures for years subsequent to 1918 seem to be included.

Limestone Quarrying — *Reports of Investigations* No. 2,479, pp. 6, obtainable on request from the U. S. Bureau of Mines, Washington, D. C., describes how limestone should be quarried to obtain the most uniform product. This is one of the series on lime-plant practice which are being prepared by Oliver Bowles.

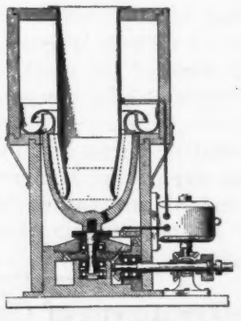
Fluorspar—"Fluorspar Mining in the Western States" is the title of *Reports of Investigations* No. 2,480, obtainable free from the U. S. Bureau of Mines, Washington, D. C. This is a bulletin of 35 pages and contains a descriptive record of all the fluorspar mines of commercial importance in the western states. Flow sheets of representative milling plants are given and methods of mining discussed.

Recent Patents

Electrodeposition of Tin—No. 1,452,573. April 24, 1923. L. D. Simpkins, Brooklyn, N. Y., assignor to National Lead Co., New York. An electrolytic bath for depositing tin, containing a tin-salt solution and small amounts of beta-naphthol and a colloid.

Sponge Iron—No. 1,452,626. April 24, 1923. E. B. Thornhill, Hurley, N. M. An apparatus for reducing metals from ores or other material, specifically for making sponge iron from iron ore, comprising a hearth on which the ore is bedded, a reducing chamber above the hearth, and heating means adapted to heat the material by radiation. Patent No. 1,452,627 covers the process of passing iron ore mixed with carbonaceous material through the apparatus. These two patents cover the successful work that has been done at the plant of the Chino Copper Co. in the last two or three years on the production of sponge iron for the precipitation of copper from leach solutions.

Centrifugal Amalgamator—No. 1,451,454. April 10, 1923. F. A. Beauchamp, Berkeley, Calif. A centrifugal amalgamating machine for the recovery of the precious metals, as shown in the accompanying illustration.



Zinc Smelting Furnace—No. 1,452,934. April 24, 1923. Björn Raeder, Kykkelsrud, Askim Station, Norway, assignor in part to Aktieselskapet Zink, of the same address. An electrode furnace containing three superposed communicating chambers, the upper one being a preliminary drying chamber, the intermediate one a preheating chamber, and the bottom a reduction chamber into which the electrode protrudes from above.

Concentrating Table—No. 1,452,969. April 24, 1923. C. C. Hebbard, Joplin, Mo., assignor of one-third to E. H. Shackelford and one-third to Otto Ruhl, both of Joplin, Mo. Mechanism for vibrating a concentrating table.

SOCIETIES, ADDRESSES, AND REPORTS

Motion Pictures of Industry Educating Public

Bureau of Mines Produces Many Films Showing Phases of Mining and Metallurgy—Desires More

BY M. F. LEOPOLD*

Visual education is taking a prominent part in our leading universities and educational institutions, and the U. S. Bureau of Mines is probably one of the first governmental agencies to carry on this work to any great extent.

Surely no industry could offer a greater variety of interesting subjects to be shown on the screen than mining, and the co-operation that has been given the Bureau by the industry has been remarkable. Films that represent an outlay of probably $500,000 have been produced under the direction of the engineers of the Bureau within the last few years, and the expense to the government for this work has been almost negligible, because the entire outlay incurred is paid for by the co-operating company, as well as the cost of providing a sufficient number of copies of the film for distribution.

The demand for these industrial films has proven to be tremendous, they being used extensively by universities, engineering schools, technical societies, chambers of commerce, boards of trade, and many other educational institutions and civic organizations. In addition to this domestic circulation, many copies of the films have been loaned to foreign governments for educational purposes, and also to foreign engineering organizations.

The Bureau of Mines is most anxious to make this library of films of the mining industry so complete that engineering and other organizations may call upon it at any time to provide films for entertainment or instructive purposes; also, that those who desire such films may learn that they represent the highest type from an educational point of view and present the subject in a comprehensive manner.

Following are a few of the subjects that have been produced up to the present time, and are available to all those desiring to borrow them by making application to the Bureau of Mines Experiment Station, Pittsburgh, Pa.:

"The Story of Coal;" "The Story of Petroleum;" "The Story of Sulphur;" "The Story of Ingot Iron;" "Saving Coal at Home;" "The Story of Rock Drilling;" "The Story of Asbestos;" "The Story of Abrasives;" "Mexico and Its Oil;" "The Story of Heavy Excavating Machinery;" "The Story of Natural Gas;" "The Story of Oxygen;" "The Story of an Electric Meter;" "The Story of a Watch;" "The Story of an Automobile;" "The Story of Compressed Air;" "The Story of Water Power;" "The Story of Transportation;" "The Story of a V-type-8 Cylinder Motor;" "The Story of a Valve-in-head Motor;" "The Story of Alloy Steel;" "The Story of Steel;" "The Story of a Gasoline Engine;" and the "The Story of Refractories." Numerous other films are now in course of preparation, and shortly will be ready for distribution.

Full recognition is given to the company that co-operates in the production of these films in the way of placing its name, together with that of Department of the Interior and Bureau of Mines, in its main title, as well as permitting the name of the company to appear in the film in such a manner that it does not appear that it was placed there for advertising purposes.

It has been the experience of the Bureau that the companies that have co-operated with it in this work (and they represent many of the largest), do not desire to have their names appear throughout the film, but only in the main title with that of the government. The reason for this is because many of them have realized through sad experience that films containing trade marks, trade names, and other forms of advertising have little value, and that their distribution is limited, and will not be used by educational institutions or civic organizations.

The Bureau of Mines desires to co-operate to the fullest extent with mining companies and manufacturers in the production of these industrial films, so that the people of this country and of foreign countries may learn, through visualization, American mining methods and efficiency employed in the manufacture of American products.

Full information as to costs, time, and methods of production of these films, as well as details in regard to their distribution, will be furnished upon such a request being made to the Bureau of Mines, Interior Building, Washington, D. C.

*Safety Engineer, U. S. Bureau of Mines.

Electrochemists Plan Meeting in Dayton

The fall meeting of the American Electrochemical Society, Sept. 27, 28, and 29, is expected to prove interesting, particularly to electrical men, chemists, foundry men, and electroplaters. It will be held at Dayton, Ohio. The technical meeting will be devoted to a symposium on "Electrochemistry of Gaseous Conduction," also to one on "Recent Developments in Electrolytic Refining of Metals."

Trade Association Facts Issued by Commerce Department

In Foreword Secretary Hoover Emphasizes Important Position in Industry They Have Come to Occupy

By publishing a 368-page book dealing with trade association activities, the Department of Commerce has supplied a large amount of information concerning a movement which has taken on much acceleration during recent years and which has not been thoroughly understood by the public. It is believed that this book will do much to dispel the uncertainty as to the standing of trade associations which has been aroused by attacks upon them. In the course of an introductory statement, Secretary Hoover of the Department of Commerce, says:

"The constructive purposes of trade associations unfortunately have been confused with the minority of activities which have been used as a cloak for action against the public interest. It is also also true that a vast amount of action in public interest has been lost and even great national calamities brought upon us by lack of co-operative action. All who know the situation in such matters realize that the problems of co-operative action are mainly the concern of smaller businesses. The material in this book has been brought together not from the point of view of educating big business but with the idea that the legitimate trade associations and other forms of business co-operation are the real basis for promotion of smaller businesses.

"The trade association as a facility for the promotion and self-regulation of industry and commerce has become, by reason of its scope and activity, an important American business institution. There are several hundred organizations in the United States which clearly come within the strict definition of the term and more than a thousand others which undertake to perform some of the services rendered by the avowed trade associations.

"Notwithstanding the importance of this institution, as an economic factor, generally speaking, the American public is little acquainted with either the extent or the character of its work. The following pages undertake to present a picture of the organization, administration and operations of trade associations."

The book is the result of an investigation undertaken jointly by the Bureau of the Census, Bureau of Foreign and Domestic Commerce, and the Bureau of Standards. It was guided and supervised by a committee headed by F. M. Feiker.

MEN YOU SHOULD KNOW ABOUT

Bulkeley Wells, president of the United Comstock Mines Co., has been on the Comstock inspecting company operations.

Alfred C. North has completed his examinations near Needles, Calif., and at Goldfield, Nev., and has returned to Galt, Calif.

D. D. Moffat, consulting engineer, Utah Copper Co., has been appointed assistant to the general manager of that company.

William G. Mather, of Cleveland, president of the Cleveland-Cliffs Iron Co., spent the first two weeks of July on the Marquette Range.

Frank M. Manson, manager of the Western Ore Purchasing Co., has returned to Reno from a business trip to New York and Washington.

Walter X. Osborn has left Gila Bend, Ariz., for Goodsprings, Nev. He will assume charge of the Calarivada Silver's mines, at Ivanpah, Calif.

J. W. Sherwin, general manager of the West End Consolidated and Halifax companies, is in Tonopah from his Oakland headquarters, inspecting local operations.

J. P. Burgess and **H. Werner Lawson,** consulting mining geologists of San Francisco, are in Tonopah on geological work for the West End Consolidated Mining Co.

C. C. Mather, of Pennsylvania, has been appointed as a mining engineer aide in the Minerals and Coal Leasing section of the U. S. Bureau of Mines, at Denver.

Rowland King, mining engineer, recently returned from the Rock Bar district of southern Idaho, where he has been examining properties of the district.

P. A. Georgiades, superintendent of Grammatico iron mines, near Marathon, Greece, informs the *Journal-Press* that his present address is 19 Rue Guizy, Athens, Greece.

John Blizard, who has had charge of the U. S. Bureau of Mines fuel work at its Pittsburgh station, has resigned to accept a position with a commercial concern in New York City.

John F. Barkley has been appointed as an assistant fuel engineer of the U. S. Bureau of Mines and will have charge of the conducting of tests for the fuel efficiency survey.

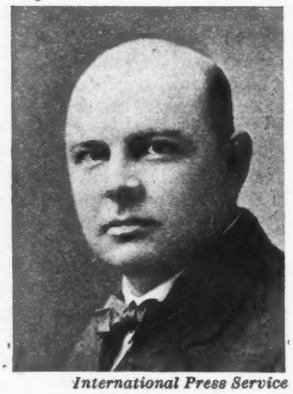
R. S. Handy, in charge of milling operations of the Bunker Hill & Sullivan mine, is at Libby, Mont., working over the concentrator of the Lukens Hazel mine for more efficient operation.

J. D. Sisler has finished his assignment as coal-waste engineer for the United States Coal Commission and has resumed his work as geologist of the Pennsylvania Geologic Survey at Harrisburg.

Adolph Knopf, assistant professor of geology at Yale, has arrived in Denver, and will soon leave for Pitkin County, where he will make a geological resurvey of the Aspen district for the government.

Dr. W. A. Caldecott, industrial adviser and metallurgist to the New Consolidated Goldfields, Ltd., has accepted the post of Director of Industries in the Department of Mines and Industries, South Africa.

Balmer Neilly was re-elected secretary of the Ontario Mining Association at the regular annual meeting of that body held on July 6. Mr. Neilly has been secretary of the association for several years.



International Press Service

Balmer Neilly
Secretary Ontario Mining Association

Sumner S. Smith has resigned from the Alaskan Engineering Commission and has organized the Alaskan Minerals Co., to operate the Hirshey mine, on Palmer Creek, and several other prospects in Alaska.

Lieutenants Gilbert C. Hoover and **John H. Keefe,** of the U. S. Navy, were awarded degrees of bachelor of science in metallurgical engineering at the June commencement of the Carnegie Institute of Technology, in Pittsburgh.

John D. Sullivan, analytical chemist at the Northwest Experiment Station of the U. S. Bureau of Mines, Seattle, Wash., has been transferred to a similar position at Berkeley, Calif., formerly filled by **K. S. Boynton,** resigned.

Dr. G. S. Hume and **Dr. M. Y. Williams,** of the Canadian Geological Survey, will conduct investigations in the MacKenzie River Valley during the present season, penetrating to areas which have hitherto been largely unexplored.

Olaf P. Jenkins, associate professor of economic geology, State College of Washington, is making a geological examination of the coals of Skagit County, Wash., for the Division of Geology, Department of Conservation and Development.

F. Dean Bradley, at present principal of the Tonopah School of Mines, has been appointed state director of vocational education, supervisor of trades and industry, and director of industrial rehabilitation, succeeding **B. H. Morrison,** who recently resigned.

W. D. B. Motter, Jr., for several years assistant consulting mining engineer to Guggenheim Bros., has been appointed assistant to the vice-president of the Chile Exploration Co., 25 Broadway, New York City. He has recently returned from a two years' stay in Chile.

S. P. Howell, formerly of the Pittsburgh Station of the U. S. Bureau of Mines, who has spent the past year in Arizona studying the mining problems of that state, especially regarding the use of explosives, has been designated as superintendent of the station at Tucson.

R. W. Stone, Assistant State Geologist of Pennsylvania, visited limestone quarries in central Pennsylvania last week, and this week has been in the Bangor slate district in consultation with C. H. Behre, Jr., who is making a detailed study of the slate belt for the Pennsylvania Geologic Survey.

Prof. Ernest A. Hersam, of the University of California, who for the past year has studied metallurgical milling problems at the Massachusetts Institute of Technology in co-operation with that Institute and with the American Institute of Mining and Metallurgical Engineers, has returned to his former position as an instructor at the University of California. **John Gross,** of the U. S. Bureau of Mines station at Reno, Nev., will go to Cambridge to continue the work which Professor Hersam has been doing.

OBITUARY

Captain Richard Trezona, pioneer mining man of the Lake Superior region, died July 9 at Rochester, Minn. He was a native of Cornwall, England, where he was born in 1847, and came to this country when a young man, going direct to the Lake Superior mines. For a number of years he was engaged in mining work in the copper field, leaving for the Gogebic Range when the first mines were opened there. Shortly after the opening of the Mesabi Range he transferred to Minnesota. For seventeen years he was superintendent of the Fayal mine, at Eveleth. Captain Trezona was pensioned by that company a few years ago, and then returned to Hurley, Wis., to spend his remaining years. Burial was at Eveleth on July 13.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

FIRE destroys the costly surface plant of the Hecla Mining Co. and part of the city of Burke, Idaho.

Details of the Mohawk-Wolverine-Michigan copper mine merger are announced. Consummation of plan expected to benefit the three properties.

Curtailment of zinc production in the Joplin-Miami district for two weeks has stimulating effect on the market.

Preparation made to drive Moffat tunnel under James Peak, in Colorado, shortening distance between Denver and Salt Lake City.

Formal invitations issued to silver producers to attend silver conference in Reno, Nev., to be held in September.

Treasury Department refuses to accede to Senator Pittman's request for a resubmission of silver allocations controversy to the Comptroller General. Senator Pittman makes a sharp rejoinder.

Bounty on copper is held to improve outlook of copper mining in British Columbia.

Colorado pushing work on its topographical surveys to completion.

New Producer Promised for Kootenay District, in British Columbia

Standard Silver-Lead Co. Opens Good Shoots in Iva Fern Group

BY F. H. MASON

The Standard Silver-Lead Mining Co. has apparently been rewarded for eighteen months of development work on the Iva Fern group of claims, in British Columbia. Since the beginning of 1918, when the directors of the company realized that the orebodies of the famous Standard mine, at Silverton, could no longer support large-scale operations, the company has been looking around for another mine, and in the search has fruitlessly explored a number of properties. In the fall of 1921, the Consolidated Mining & Smelting Co. relinquished its option on the group situated seven miles up Cultrus Creek from Kootenay Lake, after spending $30,000 in exploration, equipment, and road construction. The Standard company thereupon took the property over on a four-years' option and has been exploring it diligently ever since. It is understood that the consideration was $100,000. The Standard company continued the tunnel that had been started by the Consolidated company, to open at a depth of 200 ft. an exceedingly promising vein that had been stripped on the surface. Two months ago a 6 ft. vein was cut in the tunnel, and, this seeming to be the objective, a drift was started to the north to get under the rich surface ore. The drift was run for 40 ft. on a vein averaging 4 ft. with 2 ft. of clean lead-zinc ore, but the character of the ore did not seem to tally with that found on the surface and the vein was much smaller. A survey was made, and it was concluded that the tunnel had not reached its objective, so the driving of it was continued. In a short distance another vein was cut, but, though well mineralized, it contained no ore. A drift was started to the north, and 35 ft. from the tunnel it ran into ore assaying 18 per cent lead, 3 per cent copper, and 12 oz. silver per ton across a width of 8 ft. Thirty-five feet farther on a stringer of high-grade lead-copper ore came in and gradually widened until it occupied half of the width of the vein. The drift now has passed through 70 ft. of ore, the present face showing 4 ft. of shipping ore and 4 ft. of good milling ore. The ore is composed of bornite, galena, and a little sphalerite in a matrix of siderite and quartz.

On the surface the vein was much wider, running up to a maximum of 40 ft. It seems likely that between the surface and the tunnel the vein may have split, and the ground between the two veins is a horse. However this may be, there is little doubt that the company has struck a shoot of rich ore, the dimensions of which have yet to be determined, but sufficient work has been done to demonstrate its undoubted value.

When the Standard ceased company operations and turned the Standard mine over to lessees it had between $300,000 and $400,000 in the treasury. This was invested in readily negotiable securities, to be ready against the time when another mine should be found. The interest and the royalties from lessees have paid for the explorations that the company has undertaken, and at the last general meeting, held a few months ago, the balance sheet showed assets to the amount of $426,000, of which $375,000 was in readily negotiable securities, so the company is in a strong financial position and well able to exploit the property thoroughly. The mine is owned by the well-known prospector, W. J. Mullholland, and associates, and everyone in the Kootenay will join in congratulating "Jack" and the Standard company on their good fortune.

New Salt Mine to Be Opened

Huge Tonnage Awaits Extraction at Pierce Junction, Texas

The Crystal Salt Co. is planning to install a salt-mining plant at Pierce Junction, Harris County, Tex. The organizers are Judge B. W. Camp, and C. W. Baker, of Houston, and Senator E. G. Potter, of San Antonio. Pierce Junction is a coastal salt-dome formation, 7 miles southwest of Houston, and is a producing oil field.

The plant will be on the Camp 15-acre tract on top of the dome, and will have an initial capacity of 50 tons daily. The salt core of the dome here is within 1,100 ft. of the surface. There are several million tons of rock salt under this area, and the entire core contains an unlimited amount, which can be conservatively estimated at one billion tons.

Extraction will be made by dissolving the salt in water forced down wells. Working conditions are good. An abundance of water can be obtained from shallow wells. Fuel for evaporation, both gas and oil, is produced nearby. A good local market is assured in Houston and vicinity, as no salt is being produced in the coastal region of Texas. Excellent rail and water shipping facilities are available at Houston.

Fire Consumes Hecla's Surface Plant

Business Section of Burke, Idaho, Also Destroyed —May Be Year Before Company Can Resume Normal Operations

ALL surface buildings and equipment of the Hecla Mining Co. at Burke, Idaho, were destroyed by fire on the afternoon and evening of July 13. The Hecla is one of the largest silver-lead mines of the world, and had a modern and efficient mining plant in operation at the time. The company's electric flat-rope hoist, its elaborate machine shop, ore-sorting plant, new concrete building housing the engineering department, modern concrete change room, ore bins, one hundred thousand feet of stull timbers, company office, residences of superintendent and other officers and minor buildings were lost in the flames. The damage is unofficially estimated at over $500,000, which will be partly compensated by the insurance carried on the destroyed works—about $337,000. The company also carried $1,000,000 in "Use and Occupancy" insurance, which will go far toward providing usual income while the plant is being restored.

Hecla surface plant and part of town of Burke looking north along Canyon Creek

Building Construction All in Narrow Canyon

The surface buildings of the Hecla mine or what is left of them—are in a narrow canyon in the town of Burke. The canyon is so narrow that the two railroads serving the camp, road traffic, and pedestrians all share the one thoroughfare through the town. In fact, the Hecla mine boarding house, a large affair to the north of Burke, was built over the railroad so as not to obstruct its passage through the canyon. The surface buildings were generally of wooden construction, as well as the cribbed retaining wall upon which most of them rested. The high wind and draft created by the fire made short work of all this easily combustible material, the conflagration continuing until the entire business district of Burke had been wiped out. The fire finally stopped at the Hercules mine, to the north and on the opposite side of the canyon.

No Serious Injuries Reported

Fortunately no employees were seriously injured. The miners who were underground when the fire occurred were hoisted to the surface as rapidly as possible, until the electric power service was interrupted by the fire, thus compelling the men on the 2,000 level to climb out the main shaft and other outlets. James F. McCarthy, general manager, and L. E. Hanley, superintendent, with their staffs, were on the ground directing the fight against the flames. The fire engine and fire-fighting equipment did not last long. They were put out of efficient condition by the fire.

Resumption Waits on New Hoist

Plans are being made for replacing the burned buildings and equipment. The work of clearing the debris is progressing as quickly as possible. The resumption of operations is chiefly contingent upon the installation of a new hoist, and it may be a full year before complete restoration of the surface plant can be effected. Hecla's main shaft is 2,000 ft. deep and has not been seriously affected by the fire. The output of the mine is normally about 2,000 tons of metallic lead per month. Not only is Hecla's production from its own mines stopped, but development of the Star vein through the Hecla shaft is prevented. This project was undertaken jointly with the Bunker Hill & Sullivan Mining & Concentrating Co. and is an important part of Hecla's operations.

Successful Curtailment Policy Pursued in Joplin-Miami District

Curtailment of the production of zinc ore in the Joplin-Miami district to not more than 2,500 tons per week was accomplished for two weeks as a result of the united effort of ore producers for the first two weeks of the month. In many respects, it was the most successful curtailment attempt ever made in the field.

By the close of the second week a few mines had started up, about thirty-five altogether being reported in operation, but most of them were small properties, as many as ten not producing over five tons of zinc concentrates per day. Also, a few of the larger producers which could not get things in shape to close down on the original date, have since arranged to do so and some of them will be down next week and some for a longer period. Within a short time, therefore, the output of the field will be materially reduced.

The apparent result has been to increase the price of slab zinc, and it is admitted this rise in price will be an acid test for the scheme, which includes a continuation of the curtailment over an indefinite period. If prices are very low it is always easy to get most of the mines to curtail, but when prices temporarily improve it is a difficult matter to get them in line to maintain curtailment. However, it is estimated that the production for the rest of this summer will not exceed 9,000 tons per week, and it is believed demand will readily take care of this much ore.

The Kansas Explorations Co. had an unusual experience in its new shaft on the Foley land, just north of the Commerce Mining & Royalty Co.'s Webber mine, in Kansas. Drilling that had been done on the lease indicated heavy water at about 240 ft. The company sunk two drill holes on a lime bar and started their shaft on it. Upon reaching 240 ft. they cut a pump seat and installed pumping apparatus capable of taking care of 1,500 gal. per minute. Then they started drifting, but as yet have encountered no water, although they have drifted a considerable distance. They plan to drain the tract from this shaft.

Ford Seeks More Iron Ore

Henry Ford is seeking more iron ore on the Marquette Range and has placed a drill on a farm property, a few miles to the west of his Imperial mine, which is at Michigamme. He also has drills at work at the mine and on the Menominee Range. It is reported that he will also carry on exploratory operations to the southwest of Republic, in the Menominee River basin. His Imperial mine is unable to supply the tonnage needed by the River Rouge furnaces and it has been necessary for him to purchase ore in the market. It appears that Ford desires to become independent with regard to an adequate supply of iron ore.

Moffat Tunnel Construction to Begin Soon

New Territory to Be Served by D. & S. L. R.R. Development

With the re-election on July 10 of the members of the Moffat Tunnel Commission, and the selection of R. H. Keays, of Albion, New York, chief engineer, actual construction will commence on the 6.03-mile bore through James Peak as soon as the preliminaries can be arranged and the contract let. The tunnel is financed by bonds issued by a special improvement district comprising the counties of Denver, Grand, Moffat, Routt, and portions of Eagle, Gilpin, Boulder and Jefferson counties, and is undertaken by the Moffat Tunnel Commission authorized at a special session of the Colorado Legislature.

Plans have been prepared and a bond issue of $6,720,000 authorized to complete the bore. A contract with the Colorado Power Company has been let for the construction of a power line to the tunnel portals, and preliminary work at the site will commence about Aug. 1.

The tunnel will do away with snow blockades on the Moffat Road, as well as the stiff grades now necessary in crossing the Continental Divide; will shorten the distance something over 24 miles, and reduce the elevation at this point from 11,506 ft. to 9,190 ft.

The plans provide for the driving of a pioneer tunnel 8 x 8 ft., center lines 75 ft. from the main tunnel, which is to be 16 x 24 ft. Work on the main bore is to be prosecuted from both ends and possibly from a point midway through the pioneer tunnel. It is estimated that three years will be required to complete the bore.

The tunnel will afford improved transportation facilities for a vast territory in Northwestern Colorado possessing almost unlimited deposits of coal and rich in agriculture, stockgrowing and other mineral resources. With the construction of 45 miles of new road, the distance by rail between Denver and Salt Lake would be reduced 178 miles, and the western coast brought half a day nearer Denver.

Michigan Copper Moving in Large Tonnages

A total of 9,678,000 lb. of copper was shipped by boat out of the Michigan district in June. Of this amount, Calumet & Hecla and subsidiaries, including Ahmeek and Isle Royale, shipped 7,588,000 lb. from the Torch Lake smelter of the C. & H. group. Calumet & Hecla also shipped 250,000 lb. from its export copper storage at Dollar Bay. Copper Range, Mohawk and Wolverine shipped 1,478,000 lb. from the Michigan smelter at Houghton, and Quincy sent out 362,000 lb. from Hancock. Including rail shipments, which were comparatively small, copper deliveries during the month were approximately 1,000,000 lb. under production, for the first time this year. The surplus probably will be increased in July, judging from orders for deliveries to date. The bulk of orders are for metal in small lots. Sales to the automotive centers of late have dropped off considerably in comparison with shipments made to Detroit, Flint, Lansing, and other cities in the earlier months of the year.

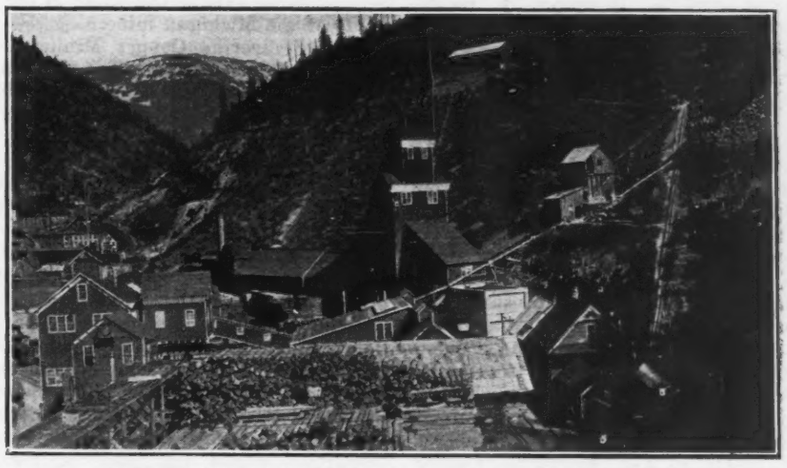
Hollinger to Build Power Plant

President Noah A. Timmins, of the Hollinger Consolidated, says that the company will proceed at once with the development of 25,000 hp. at the Long Sault on the Abitibi River, so that the mine will at all times be assured of 20,000 hp. as the minimum. It is hoped to have the work completed within a year. Plans have been made to install Diesel engines capable of developing 1,200 hp. to serve as auxiliaries in case of emergency.

Cripple Creek Receives a Boost

W. Spencer Hutchinson, a Boston mining engineer, who represents an eastern company whose name has not yet been disclosed, closed a deal July 11 for practically all of the Stratton estate mine holdings, except the stock of the Portland mine. The deal comprises a four year development plan for 582 acres of gold mining territory in the Cripple Creek district, and calls for an expenditure of $200,000 in development of the property within two years. It is stipulated that shafts are to be sunk not less than 2,100 ft. The lease is on a 17½ per cent flat royalty basis.

Included in the lease are the John A. Logan, Longfellow and Abe Lincoln mines. The properties lie on Globe and Bull Hills, and were acquired by Stratton after he had disposed of the Independence mine.



A closer view of the Hecla plant as it stood before the fire

Mohawk Not to Regrind Old Sands

Although Mohawk, in the Michigan copper district, will re-treat tailing in its new regrinding mill, now under construction, no attempt will be made to regrind the old sands, the copper content being too small to dredge out the sands. The sands contain less than 5 lb. of copper per ton and approximately only 3 lb. could be recovered. The cost of handling and re-treating would be prohibitive. Waste sand from daily operation in the mill, however, can be handled economically.

Ahmeek, which is maintaining a normal rock tonnage from two shafts, Nos. 2 and 4, yielding a refined production of 1,700,000 lb. per month, is in splendid ground at depth. Both of these shafts are bottomed below 3,000 ft. In No. 2, the levels have been extended from the 23d to the 27th, inclusive, providing a large stoping area. In No. 4, the 15th and 17th levels have been driven north to the Seneca boundary, in splendid rock, and the 19th and 21st also have been extended in the same direction. A vigorous development program is maintained in both Nos. 2 and 4, and some development work is being done in No. 3. No. 1 shaft is devoted to pumping.

Cardiff Mine, in Big Cottonwood Canyon, Utah, Makes Promising Strike

Ore has been opened at the Cardiff mine, in Big Cottonwood Canyon, Utah, in new ground, on an undeveloped fissure system, 1,000 feet to the south of the orebody thus far productive in the property. Twelve feet of ore is exposed at the point of discovery in a raise 150 ft. from the old 600 level, about 4,000 ft. from the portal. A drift continued 70 ft. further to the south has entered similar ore. The ore is silver-lead, of a value, it is said, of about $60 per ton at present metal prices.

Nickel Industry Looking Up

General Manager Rose, of the British American Nickel Corporation, states that the outlook for the nickel-mining industry is steadily improving. The company is now employing a force of nearly 800 men, and its entire output is contracted for at a fixed price. It has acquired hydro-electric power plants which provide the greater part of energy required, and before the end of the year all the power used will be electric, its latest acquisition being the plant erected by the Moose Mountain Iron Mines.

Details of Mohawk-Wolverine-Michigan Merger Released

Consummation of Plans Held to Benefit All Three Mining Companies —Stockholders to Meet Aug. 13

RELATIVE to the proposed merger of Mohawk Mining Co., Wolverine Copper Mining Co., and Michigan Copper Mining Co., which will be considered and voted upon at special meetings of the stockholders of the respective companies in New York, Aug. 13, L. P. Yandell, president, has issued the following statement to the shareholders:

"The directors of your companies have been considering for some time plans to combine the properties of your companies, which they believe will be for the benefit of the three companies.

"The following plan has been considered and is unanimously recommended by the directors of each of the above companies to the stockholders of the three companies for their earnest consideration and approval:

"It is proposed to increase the amount of the capital stock of the Mohawk Mining Co. from $2,500,000 to $2,875,000 and the number of shares from 100,000 to 115,000, all of said shares to be of the par value of $25 each. On the presently issued stock $18 per share has been paid in. The 15,000 shares representing the increase of stock will also be considered paid in, to the extent of $18 per share, through the acquisition of property.

It is proposed that the Mohawk Mining Co. exchange 10,000 shares of its increased capital for all the property and assets of the Wolverine Copper Mining Co., subject to its outstanding liabilities, which will be assumed by the Mohawk Mining Co.

"It is proposed also that the Mohawk Mining Co. exchange 5,000 shares of its increased capital for all the property and assets of the Michigan Copper Mining Co. subject to its outstanding liabilities, which will be assumed by the Mohawk Mining Co.

"This will mean that the stockholders of the Wolverine Copper Mining Co. will eventually receive one share of Mohawk Mining Co. stock for each six shares of stock now owned by them in the Wolverine Copper Mining Co., and that the stockholders of the Michigan Copper Mining Co. will eventually receive one share of Mohawk Mining Co. stock for each twenty shares of stock now owned by them in the Michigan Copper Mining Co.

"Your boards of directors have called meetings of the three companies to be held on the thirteenth day of August, 1923, for the purpose of securing the approval of the stockholders of the respective companies to the above plan.

"In order to increase the capital stock and number of shares of the Mohawk Mining Co., the statute requires a two-thirds vote of the stock. In order to authorize the transfer of the properties and assets of the Michigan Copper Mining Co. and the Wolverine Copper Mining Co., a vote of three-fourths of the stock of those two companies respectively will be required.

"The directors of the three companies have carefully considered this proposition from every angle and believe that its consummation will work equitably to the advantage of the stockholders of each of the companies.

"When this plan is approved, the Mohawk Mining Co. can secure mineral ground to a depth of 10,000 ft. on the Kearsarge lode and to unlimited depth on the Knowlton, Butler, Ogima, and Evergreen lodes, the Butler lode at present showing substantial value in the E shaft of the Michigan mine.

"The Wolverine Copper Mining Co., through the consummation of this plan, would deliver to the Mohawk Mining Co. options covering the mineral ground on the Kearsarge lode at depth, and, in so doing, would secure an interest in a mining proposition which should have a long life without the need of further financing.

"The Michigan Copper Mining Co. will avoid refinancing, delivering its proven ground to the Mohawk Mining Co., under whose management operations could begin at once with adequate working capital for development of the properties. The issuing of 15,000 shares additional stock of the Mohawk Mining Co. for the acquisition of these two properties would put both Michigan Copper Mining Co. and Wolverine Copper Mining Co. on an equitable dividend basis with Mohawk Mining Co. Economies would be effected by the saving of overhead expense and increased production would be made possible, and through the assured long life of the Mohawk Mining Co. your investment should have a more stable standing.

"Your directors recommend the foregoing proposition to the earnest consideration of the stockholders and hope for its hearty approval."

In connection with the proposed merger of the Mohawk, Wolverine, and Michigan copper properties, in the Lake Superior district, the Wolverine Copper Mining Co. has obtained options on 160 acres of mineral lands from C. C. Douglass Co. and Shelden estate, of Houghton. The tract, which lies to the west of Wolverine, Osceola land intervening, carries the Kearsarge lode at depth. It is proposed to open the vein by means of vertical shafts. It is these options which Wolverine will deliver to Mohawk if the merger plan meets with the approval of the stockholders of the respective companies. The optioned tract lies on the strike of the formation, in the same zone in which Mohawk, Wolverine, Ahmeek, Seneca, and North Kearsarge are opened. The rich, uniform mineralization of the vein in this particular area affords the basis of belief that it would prove commercial in the new Wolverine tract.

Opinion expressed in Michigan mining circles is to the effect that the proposed consolidation is advantageous for the stockholders of the three companies. It would give Mohawk a long lease of life on the Kearsarge vein and provide present Wolverine shareholders the only chance they could possibly expect of receiving an adequate return from their investment. As for Michigan it would mean the immediate resumption of operations and a vigorous development of lodes of known value, particularly the Butler, which has developed high grade commercial rock in E shaft. A merger would, it is held, lengthen the life of all of the companies, reduce operating costs and increase production far beyond present possibilities.

Yellow Pine Makes New Strike

The Yellow Pine Mining Co. of Goodsprings, Nev., has picked up the Northern extension of the orebody 800 ft. north of the original discovery shaft. The work done up to the present time would indicate that the ore is considerable higher in silver values, and as good or better in lead-silver than the general mine run that has been produced in the past.

Pyramid Mining Co. Expands Operations

The Pyramid Mining Co. has taken over the Gilliam mine at Waco, Mo., and has placed the mill in shape preparatory to operations. It is also sinking a field shaft to the north and west of the mill where drilling indicates a good orebody. Deposits on other portions of the lease, in what is known as the upper ground, have proved spotty and it has been difficult to operate the mine at a profit except when ore prices were comparatively high. The company expects to dewater the ground and work at the lower level.

Ford May Buy a Copper Mine

Although the belief is held in the Michigan district that Henry Ford eventually will acquire a copper mine, there are difficulties which stand in the way of the consummation of such a hope. It is a well-known fact that Mr. Ford wants absolute ownership in any property he takes over, and inasmuch as all of the Lake copper companies are share ownership corporations he probably would have trouble in obtaining complete control of any one of them. The same difficulty would confront him in other districts as well. It is held by some mining men that although Mr. Ford owns iron and coal mines, he really has no present need of taking over a copper property, for the reason he can buy all the metal he needs in the open market at a reasonable price. Mr. Ford's intentions, however, remain an interesting subject of discussion.

News from Washington

By PAUL WOOTON
Special Correspondent

Treasury Refuses to Resubmit Silver Question to Comptroller General

Under Secretary Gilbert Makes Brief Rejoinder to Request for Resubmission—Senator Pittman to Refer Matter to an Impartial Tribunal

Under Secretary Gilbert Says:

"THE Treasury's action in adjusting the accounts of the mints has thus saved the people of the United States at least five million dollars that would otherwise have gone to subsidize the silver industry. The action taken was clearly in the public interest, and though apparently not acceptable to the silver interests of Nevada should commend itself, I believe, to the Commission of Gold and Silver inquiry, a committee of the Senate of the United States which was appointed to serve the interests of the people as a whole rather than the special interests of a single class."

THE Under Secretary of the Treasury has declined to resubmit the matter of silver allocations to the Comptroller General of the United States, as requested by Senator Pittman, acting for the Commission of Gold and Silver Inquiry. He declares that the long letter of Senator Pittman, dated July 9, contains nothing that would justify the Treasury in resubmitting the matter. This has led Senator Pittman to advise Under Secretary Gilbert, who in the absence of Mr. Mellon is the acting Secretary of the Treasury, that he will urge the Comptroller General to reinvestigate the matter on his own motion.

Extracts from Under Secretary Gilbert's letter follow:

The statement of fact contained in my letter of Nov. 2, 1922, first submitting the case to the Comptroller General, was prepared by the Bureau of the Mint on the basis of its records and accounts, and is correct. The Comptroller General furthermore, as chief accounting officer of the government, had full access at all times to the records and accounts of the Bureau of the Mint and of the several coinage mints and at the Treasury's request made independent investigations into the facts before rendering his decision on Nov. 29, 1922. There is no question but that the standard silver dollars involved in the allocations were actually broken up and melted and this is expressly stated as one of the facts in the Comptroller General's decision. It was also expressly stated in my letter of Nov. 2, 1922, to the Comptroller General that the "allocations of silver for subsidiary coinage under the Act were made in part to make up shortages at the individual coinage mints rather than for the mint service as a whole, and in part to supply refined silver immediately available for coinage, where the silver already on hand was unrefined."

As to the coinage into subsidiary silver, it must be clear that once melted into bullion the silver could not be earmarked and treated separately from other silver in the mints. The silver bullion carried by the mints is held for practical purposes in one mass, separate accounts being kept on the books of the Bureau of the Mint showing the bullion carried in the subsidiary silver bullion account and the standard silver dollar bullion account. Adjustments between these accounts are made from time to time, without physically affecting the silver bullion, in order to reflect the operations of the mints, but it is always impossible to earmark the silver bullion in the several accounts, or to identify any coins as having been made from a particular lot of silver.

In general, I notice that your letter deals solely with the technical points relating to the melting of standard silver dollars and the coinage of bullion into subsidiary silver. These points are covered by the Comptroller General's decision and it is unnecessary further to discuss them. I do not find it anywhere disputed that the action which the Treasury has taken in respect to the reversal of the allocations for subsidiary coinage, and the subsequent recoinage of this silver into standard silver dollars, have merely restored the situation to what it would have been had the allocations never been made. This fulfills the primary purpose of the Act which was to relieve an emergency and restore the silver currency to what it was when the Act was passed, and it has been done without purchasing silver under the Act at the price of $1 per ounce by transferring back to the standard silver dollar account an amount of silver carried in the subsidiary silver bullion account which has been lying in the mints at all times since the original allocations were made. To do otherwise, and follow the course which you recommend, would mean purchasing over ten million ounces of unnecessary silver at the artificial price of $1 an ounce, at a loss of over 35 cents an ounce as compared with the ordinary market price, and carrying an equivalent amount of silver as a dead asset in the Treasury at a heavy loss for interest and other carrying charges. The Treasury's action in adjusting the accounts of the mints has thus saved the people of the United States at least five million dollars that would otherwise have gone to subsidize the silver industry. The action taken was clearly in the public interest, and though apparently not acceptable to the silver interests of Nevada, should commend itself, I believe, to the Commission of Gold and Silver Inquiry, a committee of the Senate of the United States which was appointed to serve the interests of the people as a whole rather than the special interests of a single class.

In his reply to Secretary Gilbert, Senator Pittman says:

Hon. S. Parker Gilbert, Jr.,
Acting Secretary of the Treasury,
Washington, D. C.

July 14, 1923.

My dear Mr. Secretary:

I am in receipt of your letter of July 13, 1923, in reply to my letter of July 9, 1923, wherein I requested the Treasury Department to petition the Comptroller General of the United States for a rehearing upon the question of authority to revoke allocations of silver for subsidiary coinage under the Act approved April 23, 1918, sometimes known as the Pittman Act.

You say, "The statement of facts contained in my letter of Nov. 2, 1922, first submitting the case to the Comptroller General, was prepared by the Bureau of the Mint on the basis of its records and accounts, and is correct."

I have no doubt that the records and accounts of the Mint are correct. In fact, such records and accounts prove the assertions that I have made, and absolutely disprove the statement made by you in your letter to the Comptroller General submitting the case wherein you said that "The result of these transactions is that the mint service now carries in its subsidiary silver account silver bullion amounting to 10,247,976.52 fine ounces, remaining from allocations under the Act of April 23, 1918."

You attempt to excuse this statement in the letter to which I am replying by saying, "As to the coinage into subsidiary silver, it must be clear that once melted into bullion the silver could not be earmarked and treated separately from other silver in the mints."

This statement is also untrue. The records of the Mint, which you say are correct, show these facts: That the 1,000,000 standard silver dollars allocated Sept. 7. 1918, were melted up at the Mint in San Francisco; that all of the silver bullion derived from such melting was immediately made into subsidiary coin ingots; and that all of those ingots were used in manufacturing subsidiary coin. The records of the San Francisco Mint show that there was no refined silver on hand at that Mint to supply such ingots without the use of the bullion contained in the 1,000,000 standard silver dollars.

The 10,000,000 standard silver dollars allocated Nov. 28, 1919, were melted up at the Philadelphia Mint. The record of the Mint discloses that the silver bullion derived from such melting was immediately made into subsidiary coin ingots, and that these ingots were used in manufacturing subsidiary coin. I beg to call your attention to the fact that at the time that allocation was made there was only 1,000,000 ounces of subsidiary silver in the Philadelphia Mint, and that such Mint was using 80,000 ounces a day in the manufacture of subsidiary coin.

The same condition existed at the Denver Mint at the time that 111,168 standard silver dollars were allocated on Nov. 6, 1920.

Your statement to the effect that the

silver could not be earmarked and therefore it could not be determined whether it was used in the manufacture of subsidiary coin or not might be excused if there had been a vast admixture of silver bullion in the melting room at the time that these allocated silver dollars were melted up, but, in view of the fact that such records disclose that these standard silver dollars constituted substantially the entire melt in each case, that ingots were immediately manufactured from the bullion, and that subsidiary coin was manufactured from such ingots as fast as they could be supplied, any possibility of such bullion not going into subsidiary coin is eliminated. According to the records of the Mint, which are contained in the hearings, both in the evidence of Mr. Frantz, the auditor for the Mint, and in the evidence of Mr. Reid, the special auditor of the commission, and in the report submitted by him, and in the testimony of Miss M. M. O'Reilly, Acting Director of the Mint at the time such allocations were made, the subsidiary coin ingots used in the manufacture of subsidiary coin could not have been obtained without the use of all of the bullion contained in such standard silver dollars.

In your letter to me, to which this letter is a reply, your admission that the allocations were "to relieve an emergency," exposes the deception in your argument that it could not be proven that the bullion derived from such allocations went into subsidiary coinage.

You say, "I do not find it anywhere disputed that the action which the Treasury has taken in respect to the reversal of the allocations for subsidiary coinage, and the subsequent recoinage of this silver into standard silver dollars, have merely restored the situation to what it would have been had the allocations never been made. This fulfills the primary purpose of the Act, which was to relieve an emergency and restore the silver currency to what it was when the Act was passed, and it has been done without purchasing silver under the Act at the price of $1 per ounce by transferring back to the standard silver dollar account an amount of silver carried in the subsidiary silver bullion account which had been lying in the mints at all times since the original allocations were made."

I do not dispute that such action restores the status quo prior to the allocations, but I do contend that it was not restored in accordance with the express mandate of the Act under which the allocations were made.

The Mint service has a right to purchase silver anywhere, either foreign or domestic, and at any price, for the purpose of manufacturing subsidiary coin. On June 20, 1920, silver went below $1 an ounce. Could you have purchased in the open market for less than $1 an ounce silver for the subsidiary account of the Mint and then used such silver to recoin the standard silver dollars and thus restore the condition prior to the allocation and melting up of such standard silver dollars? The Act expressly provides that silver for such purposes shall be purchased from American-produced silver at $1 an ounce. If you could not have done this, then how could you use silver that had been purchased in the past under the general authority of the Mint but not under the Pittman Act? Could you have purchased foreign silver for the subsidiary account of the Mint under your general authority but not under the terms of the Pittman Act and then used such silver to restore the standard silver dollars? If you could not do this, how could you use silver in the subsidiary account which had been purchased under other acts than the Pittman Act, and a part of which undoubtedly contained foreign silver, to replace these standard silver dollars?

You have treated the allocations of the silver in the standard silver dollars as a loan for the purpose of meeting an emergency. There is no authority in the Pittman Act to use such standard silver dollar as a loan. The Act was intended to meet an emergency it is true, at home as well as abroad. It expressly treated the allocation as a sale, just the same as the delivery of such standard silver dollars melted or broken up constituted a sale to Great Britain.

The Act itself expressly states that, "The allocation of any silver to the Director of the Mint for subsidiary coinage shall, for the purpose of this Act, be regarded as a sale or resale." Under what authority do you treat it as a loan?

The Act further states, "That upon every such sale of bullion from time to time the Secretary of the Treasury shall immediately direct the Director of the Mint to purchase in the United States, of the product of mines situated in the United States and of reduction works so located, an amount of silver equal to three hundred and seventy-one and twenty-five hundredths grains of pure silver in respect of every standard silver dollar so melted or broken up and sold as bullion."

There isn't any doubt that it was allocated, and there isn't any doubt that the Act prescribed that that allocation should be treated as a sale.

Notice that in this case it does not say that such silver shall be repurchased after the bullion has been coined into subsidiary coin. In my first letter to you I argued that the allocation did not depend upon whether the bullion was actually coined into subsidiary coin or not, because the Act did not attempt to provide any control over such coinage. Your argument now, that it is impossible to tell whether or not the particular bullion went into subsidiary coin, justifies the Act in requiring purchase of silver from American production to replace such melted up standard silver dollars as soon as allocated and melted. The Secretary of the Treasury was commanded by the Act to "immediately direct the Director of the Mint to purchase in the United States, of the product of mines situated in the United States," etc., at $1 an ounce sufficient silver to recoin such standard sliver dollars.

Did the Secretary of the Treasury issue such an order? The record shows that he did in each case. Did the Director of the Mint carry out such order? The record shows that he did in each case. Was the required amount of silver purchased in accordance with such orders? The record discloses that it was in each case. The record shows that there was purchased at each of such mints, after each of such allocations, a sufficient number of ounces of silver, in accordance with such orders, to cover the number of ounces of silver contained in the standard silver dollars allocated and melted up.

When those purchases were made, in accordance with such orders, that silver so purchased became instantly allocated or applied, to the extent of the number of ounces contained in such silver dollars so allocated and melted, by force of the Act itself. In other words, when the silver was purchased under such orders and under the authority of the Act sufficient to restore the standard silver dollars so melted up, there was but one duty for the Treasury Department to perform and that was the ministerial duty of seeing that that silver so purchased was immediately coined into standard silver dollars and replaced in the Treasury of the United States in lieu of those allocated and melted up.

The records disclose that a sufficient amount of silver was purchased under said orders prior to Jan. 1, 1921, to cover every ounce of silver contained in said standard silver dollars so allocated and melted up. So, on Jan. 1, 1921, the Treasury Department had caused to be purchased under the Act and had on hand sufficient silver to recoin and restore to the Treasury of the United States every silver dollar so allocated and melted up under said allocations.

Notwithstanding all of these acts, and the plain ministerial duty of the Treasury Department to recoin such standard silver dollars so allocated and melted up from such silver so purchased, you, on Dec. 19, 1922, nearly a year after such silver was all purchased, revoked such allocations, treated such allocations simply as a loan, in open and flagrant violation of the statute under which you had been acting, and now you attempt to replace those standard silver dollars, which were admittedly allocated and melted up in accordance with the Act, by coining into standard silver dollars other silver than that purchased under the Act which permitted such allocations. And I may say that there is no other act or authority of law for the allocation and melting up of such standard silver dollars for subsidiary coinage

Senator Pittman Replies:

"AGAIN, you appeal to the applause of the people of the country by asserting that through your violation of your duty you have saved them $5,000,000. You have not a very exalted opinion of the people of the United States. The time never has been and never will be when the people of the United States will countenance the violation of an expressed Act of Congress by any ministerial officer of the government based on the unworthy argument that it will save $5,000 000, which the government, by Act of Congress, was solemnly obligated to spend. Has it arrived at that point of arbitrary bureaucracy where an Under Secretary of the Treasury may place his judgment against the practically unanimous judgment of the Congress of the United States?"

than the Pittman Act. In that Act alone you found authority to melt up those standard silver dollars, and in that Act alone you must find authority for the replacement of those standard silver dollars.

Again, you appeal to the applause of the people of the country by asserting that through your violation of your duty you have saved them $5,000,000. You have not a very exalted opinion of the people of the United States. The time has never been and never will be when the people of the United States will countenance the violation of an express act of Congress by any ministerial officer of the government based on the unworthy argument that it will save $5,000,000, which the government was solemnly, by act of Congress, obligated to spend. Has it arrived at that point of arbitrary bureaucracy where an Under Secretary of the Treasury may place his judgment against the practically unanimous judgment of the Congress of the United States?

If the Treasury Department had been compelled to meet the emergency for subsidiary coins by purchasing in the open market, the government would have had to have paid $1.30 an ounce for nearly every ounce of such silver contained in such standard silver dollars so allocated. Instead of that, while silver in the open market was selling above $1 an ounce, the Treasury Department took advantage of this Act and used the standard silver dollars with the understanding that they could be replaced with silver purchased under the Pittman Act at $1 an ounce. If the Treasury Department had been compelled to go into the open market and buy silver to meet the emergency, the miner would have received $1.30 an ounce for his silver.

And yet today, through flagrant violation of the Act and repudiation of the contract of the government, you seek, after having used these standard silver dollars under the Act, to replace them with silver, a part of which is undoubtedly foreign silver, at a valuation of 65 cents an ounce.

You know, or should know, that western Senators and western Congressmen could have forced into the Pittman Act the requirement that all standard silver dollars so melted or broken up and sold should not be sold for less than $1.29 an ounce instead of $1 an ounce. You undoubtedly know that it was the patriotism of the western Senators and Congressmen that induced them to compromise on $1 an ounce, and to assist in passing the bill through Congress.

When an effort was made in the House of Representatives to repeal the purchase clause under the Pittman Act, the Treasury officials of the former Administration went before the Committee of the House and opposed such bill on the grounds that the government had entered into a solemn contract with the silver producers of the country, who permitted the passage of the Act, and that bill died in committee.

You say that your action is, "apparently not acceptable to the silver interests of Nevada." Let me call your attention to a statement in a resolution by the Western Division of the American Mining Congress adopted June 11, 1923, at San Francisco, California, which resolution has been placed in the record of the hearing. The resolution states, "It therefore urges that the executive officers of the American Mining Congress, in conjunction with the producers of Western States, immediately take such steps as may be necessary to bring the matter before the proper courts for disinterested consideration and judicial action, to the end that a situation which has caused producers to question the good faith of the government may be clarified and that silver producers receive, fully and exactly, the benefits provided under the Act, regardless of the action of a department that is wrongfully endeavoring through widespread propaganda to decieve the people into believing that producers seek an unfair interpretation of the Act."

It is true that the Comptroller General may have had access to all of the records and accounts in the Bureau of the Mint and the Treasury Department, but doubtless the Comptroller General accepted your statement that there remained of the silver so allocated 10,247,976.52 ounces, such silver not having been used or needed. The Comptroller General certainly is not interested in any sentimental question that may be involved. He is a capable lawyer. He has demonstrated his solicitude for the welfare of the government. He has insisted that the departments administer the law as it is, and not as they would have it. It is a notorious fact that some of the departments are complaining against this insistence upon the part of the Comptroller General, and I am not surprised that you refuse, therefore, to resubmit the question of authority to revoke the allocations upon all of the evidence that has been taken upon the subject by the Senate Commission of Gold and Silver Inquiry.

I will urge the Comptroller General, on his own motion, to reinvestigate this matter, and to give consideration to all of the hearings taken in this matter, and which were submitted for your consideration.

You call attention to the fact that I have confined my argument to the standard silver dollars. I did so because I was only dealing with the opinion of the Comptroller General in this particular correspondence. I am prepared to show, however, from the evidence, that of the 6,000,000 ounces of silver allocated on Oct. 18, 1920, and Dec. 18, 1920, obtained from the purchase of Pittman silver, that there were over 3,000,000 ounces actually used in the manufacture of subsidiary coin. From your attitude in this matter, it is evident that such a submission to you would be a waste of time, and therefore it will be submitted to some more impartial tribunal.

Very truly yours,
KEY PITTMAN.
Chairman of the Subcommittee, and Vice-Chairman of the Senate Commission of Gold and Silver Inquiry.

Silver Producers Invited to Reno

Many Important Matters To Be Discussed

INVITATIONS were issued July 16 by Senator Oddie, the chairman of the Senate Commission of Gold and Silver Inquiry, to the silver producers throughout the hemisphere to attend a convention at Reno, Nev., to begin Sept. 4. Since Reno is centrally located for silver producers, it was decided that it would be appropriate to have the meeting in a silver-producing state rather than at Washington. The invitation is addressed to "The Silver Producers of the Americas" as follows:

"The Senate Commission of Gold and Silver Inquiry was created by Senate Resolution 469 of March 3, 1923. The commission is authorized to investigate and report to Congress on Jan. 1, 1924, upon the following subjects:

"1. The causes of the continuing decrease in production of gold and silver.

"2. The causes of the depressed condition of the gold and silver industry in the United States.

"3. The production, reduction, refining, transportation, marketing, sale and uses of gold and silver in the United States and elsewhere.

"4. The effect of the decreased production of gold and silver upon commerce, industry, exchange and prices.

"The commission is further authorized—(1) to confer with citizens, associations, or corporations of foreign countries with a view to the stabilization and wider use of silver in exchange; (2) to propose, either formally or informally, to the President of the United States, or to the heads of the proper departments, plans for negotiations with foreign governments to the same end.

"The commission will hold a meeting at Reno, State of Nevada, U.S.A., on Sept. 4, 1923, at which the representatives of the silver producers of the United States, Canada, Mexico and Central and South America are cordially invited to appear and informally to discuss the various questions relating to the inquiry of the commission.

"Suggestions will be invited by the commission with regard to legislation to be proposed in its report to Congress, and those present will be invited into a conference where the freest discussion may be had, and at which the organization of a silver export association under the Webb-Pomerene law, or under future legislation, will be considered and matured, if the conference so decides. It is the opinion of many experts in such matters that such an association could render great assistance in the production of silver in all of the Americas and in its orderly marketing, so as to meet seasonal demands and prevent unfair and detrimental control over its price. These experts believe that the formation of an association of this character would do much to avoid the necessity for additional legislation for the encouragement of silver production.

"Exports in foreign exchange, transportation, the uses and marketing of silver, the production, reduction and refining of silver, the relation of the production and price of silver to export trade and commerce, and upon such other subjects as may bear upon the investigation, will give testimony.

"The commission, believing that it is impracticable to consider bimetallism, or the free coinage of silver, at these hearings, and because of the limited time available, will exclude therefrom any material relating to or discussion of these subjects.

"Your courtesy in promptly advising the commission of the name and address of your representative, will be greatly appreciated."

Ask to Have Magnesium Tariff Increased

The Tariff Commission has ordered an investigation of costs of production of magnesium, looking to a possible change in rate of duty, on application of the American Magnesium Corporation, of Niagara Falls, N. Y., which has asked an increase in the tariff duty.

The corporation applying for an increase in duty is said to be producing magnesium by a new process and at lower cost. Present uses of the metal are restricted, but as development holds promise of reducing the cost, it has been felt that there is much in the future for magnesium. Its use in flashlight powders and other near-chemicals has been greatly extended in recent years into the strictly metals field. Being lighter than aluminum and more durable for some uses, arguments before Congress last year indicated that the probable future use of magnesium will be as a substitute for aluminum.

Paragraph 375 of the 1922 Tariff Act provides a duty of 40c. per lb. on metallic magnesium and scrap and a duty of 40c. per lb. on the metallic magnesium content, plus 20 per cent ad valorem on magnesium alloys, powder, sheets, ribbon, and manufactures of magnesium. The 1913 tariff provided a duty of 25 per cent ad valorem on the metal and alloys and of 20 per cent on manufactures of magnesium.

Germany is the principal competitor of the domestic magnesium plants.

More War Minerals Distributions

Awards under the War Minerals Relief Act have been made as follows: R. E. Urquhart, manganese, $6,223.68; A. H. Freeman, manganese, $1,636.37; Needles Mining Co., manganese, $738.24. The following claims have been disallowed: Williamson and Mullins, chrome, right to award not established; William H. Cureton, chrome, commercial importance not established; Barneberg and Barneberg, chrome and manganese, no further award allowed; Eagan, Ruoff and Hinker, chrome, no further award allowed; George A. Hyde, chrome, no further award allowed; John Roberts, tungsten, commercial importance not established; Howell and Ross, chrome, earlier stimulation not established; Drennan, Epperly and Hildreth, chrome, no further award.

News by Mining Districts

By Special Correspondents in the Field

London Letter

Diamond Industry Improving—Mining in Colar Gold Field Hampered by Caving — Randfontein Central Operations Handicapped

BY W. A. DOMAN

London, July 5—It is announced that P. Ross Frames, C.M.G., has been appointed chairman of De Beers Consolidated Mines. He has been a member of the board for some time and is managing director of the Premier (Transvaal) Diamond Mining Co., now controlled by the De Beers; he is also a member of the executive committee of the Transvaal Chamber of Mines. The deputy chairmanship falls to Edwin S. Montagu, who only joined the board early this year to fill the vacancy created by the death of Sir Carl Meyer. He was formerly Secretary of State for India, under the Lloyd George régime, and has considerable administrative ability, so that there is nothing surprising in his rapid advancement.

That the diamond industry is steadily improving is clear from the chairman's remarks at the Jagersfontein meeting in Johannesburg. For the year to March last sales of diamonds realized £455,756, against only £18,498 for the preceding twelve months. Last year 30 per cent was paid, and an interim distribution is foreshadowed in September. The company produces the finest stones, for which there is normally a ready market, particularly in the U. S.

While on the subject of diamonds, I may mention that Sir Edward McKay Edgar and Sperling & Co. are evidently out to develop their properties in the mandated territory of Southwest Africa, acquired by them from the former German owners. A small company, called the Namaqua Diamond Co., was formed in Cape Town early in the year, and I understand that an issue of 500,000 shares is now being underwritten. The diamonds are small, but are found over a large area consisting of a strip 40 miles long by a few miles broad, lying parallel to the coast between Walfish Bay and Conception Bay.

Many of the mines of the Colar Field (India), which are working at great depths, suffer from periodical rock bursts, and in some cases the question as to whether it will be possible to continue profitable operations for any great length of time is becoming acute. The Champion Reef, which, under the management of John Taylor & Sons, has been a regular gold producer since 1892, has been unfortunate in this respect, and after many minor and some serious accidents, now announces that a heavy fall of rock has blocked Carmichael's shaft below the 43d level, stopping development and reducing output by over 50 per cent for two months.

Complaints are becoming frequent that reports as to developments on the B. C. Silver (Salmon River) property, controlled by the Selukwe, are not regular and informative. The company is supposed to be using the Premier tramway for its supplies and materials, and the mill of that company for the treatment of its ores. It is suggested that A. E. Banks should insist upon the publication of his reports.

The Randfontein Central, which is under the Johannesburg Consolidated Investment, or Joel, control, and which owns a huge property at the extreme western end of the Rand, suffers a handicap as compared with properties in the middle and east of the field. The reefs dip at a very steep angle, and this not only makes the mine unpopular with the natives, but restricts the use of machine drills. However, the internal workings have been reorganized, and after years of struggle and adversity, and the expenditure of much money, the company is now prospering. Some of the Johannesburg shareholders are apparently anxious that the company should be amalgamated with the Randfontein Estates, which has acted as its financial godmother, and I understand the London representatives of the respective concerns are considering the matter.

Johannesburg Letter

Rate of Gold Output Lower in May—Sherwood Starr Property, in Rhodesia, Building Mill

BY JOHN WATSON

Johannesburg, June 12—The Transvaal gold output for the month of May was announced by the Chamber of Mines on June 9 as 786,564 fine ounces, having a realized value of £3,480,545. This is an increase over the April output of 42,913 fine ounces, equal in value to £227,072. May had twenty-seven working days as against twenty-five in April; the daily average output was really 614 oz. below the April working. Three public holidays occurred during May, and although these are not recognized by the mines, they may have helped to disorganize the daily routine work. The realized price of the gold for May was 88s. 6d. per fine ounce, which is 1s. more than the April price. Among the largest producers, Crown Mines come first, with 69,911 fine ounces, Government Areas are second, with 64,595, New Modder third, with 57,721, and Randfontein fourth, with 52,855. The native labor returns show a further decrease of 2,746 on the gold mines, whereas the diamond mines show a further increase of 808 "boys."

The Minister for Mines and Industries, in answer to a question by Leslie Blackwell, stated on June 5 that a large area of ground between Ermelo and Breyten (East Transvaal) has been reported as containing torbanite. The Mines Department has been in touch with a syndicate there interested. The government oil committee will watch further experiments on behalf of the government. The minister has no complete report at present to lay on the table of the House of Assembly.

Presiding at the annual meeting of the South African Townships, Ltd., on June 6, Sir Julius Jeppe said the company had lately acquired a substantial interest in the Sherwood Starr, a gold proposition in Rhodesia, not far from

the Globe and Phoenix mine, in the Que Que district. Results of development to date indicate a highly profitable venture. Work started there early this year, a milling plant is now being erected, and it is expected to crush 2,000 tons or so per month by the end of this year. Development is exposing very satisfactory values.

On the local Stock Exchange, the feature of the week has been the steady inquiry for favorable investment shares. Early in the week, city checks were in demand for London. Government Areas have been in steady demand and have appreciated about 4s. 6d. during the week, closing at 116s. It has been suggested that these shares might be split, with advantage to the smaller investors.

BRITISH COLUMBIA

Bounty on Copper to Stimulate Mining

L. W. Humphrey, member of the Canadian House of Commons for the District of West Kootenay, referring to the Dominion Government's action in placing a bounty of 1½c. per lb. on Canadian copper products, said that the result would be the opening up of a British Columbia copper rod mill built at a cost of close to half a million dollars. Mr. Humphrey was speaking of the plant of the Consolidated Mining & Smelting Co. at Trail. He also said that employment would be created for from three to five hundred men and copper would be produced in Canada for which at present $3,500,000 is spent annually in the United States. Within thirty days of the coming into effect of the bounty the mill would be in operation.

Noble Five Will Resume

The Noble Five Mine, in the Lardeau, is to resume operations. The mine, which was a prominent producer in early days of the district, has been bonded to Vancouver parties by Alex McLean, the owner, and $5,000 has been paid on the bond. The principal sum is not made public.

Men are being taken on in large numbers in the Rossland mines, which have been shut down for some time. The mines will be in active operation by Aug. 1, according to reports from the camp. At this date the large concentrator at Kimberly will start work on the ores of the Sullivan mine and release the concentrator at Trail.

NEVADA

Bluster Con., at Jarbidge, Nev., Will Build Cyanide Plant

The Bluster Consolidated Gold-Silver Mines Co., of Jarbidge, Nev., has successfully financed new construction work. Excavations for an 80-ton cyanide mill are about completed and construction of foundations and buildings are well under way. Orders have been placed for machinery. The Dorr counter-current continuous decantation with an Oliver filter is to be used. S. K. Dahl, of Los Angeles, is consulting engineer for the new works.

ONTARIO

Davidson Consolidated Mill Burns

The 10-stamp mill of the Davidson Consolidated, at South Porcupine, was completely destroyed by fire on July 9. It is announced that the management will not be seriously embarrassed, as the mill was merely used for testing purposes. At the annual meeting of the company in Toronto on July 12 the shareholders were informed that tenders had been called for sinking a new shaft to the depth of 1,000 ft. and plans prepared for the construction of a mill.

Will Develop Quebec Prospects

The Quebec Gold Rand Co., Ltd., has been organized to take over 6,000 acres of mining properties in the new northern Quebec gold area, now controlled by a British-Canadian syndicate, including Lord Charles Montague, and associates, represented in Canada by the Duke of Manchester and several prominent Canadian mining men. It is stated that negotiations are pending for the acquisition of other properties, the syndicate having in view operations extending along a mineral belt 150 miles in length beginning at Lake de Montigny and continuing through Rouyn, Coulson, and Beatty townships on to the Platt Veteran claim, near the Hollinger. Engineers representing the English interests have sailed from London to make an examination of the belt.

COLORADO

Topographic Surveys To Be Pushed

At the last session of the Colorado Legislature an appropriation of $25,000 was made to match a like amount furnished by the U. S. Geological Survey to expedite the completion of the topographical survey of the State of Colorado, now about 50 per cent complete.

The work will be under the general supervision of Glenn S. Smith, topographer in charge of the Rocky Mountain Division. Field work commenced July 10 on the Pagosa Springs quadrangle, with B. A. Jenkins in charge, and Lee Morrison, formerly with the International Boundary Commission, as assistant. When the topographical survey is completed, the geological survey will follow, and it is expected that the work on this quadrangle will be completed so that a complete geological map of that district can be issued by the government early next year.

The work in this district is awaited with much interest by mining men, as the mineralization seems promising and there are known to exist seven major faults and consequent minor faulting, with favorable conditions for the deposition of mineral in commercial quantities.

Work was also commenced on the Evergreen quadrangle, which is to be tied into the Georgetown quadrangle, and a new map issued including both under the name of the Denver Mountain Parks Quadrangle. This work is in charge of H. H. Hodgson and seven assistants from Washington.

CALIFORNIA

Co-operative Mining in Alaska

Early in July a party of 105 men, women, and children left San Francisco for Nome, Alaska, in the schooner "Fred J. Wood." Under the leadership of A. H. Moore, the holdings of the El Dorado Mining Co., 25 miles from Nome, will be worked during the open season. The party, according to announced plans, will return during October. The equipment of the expedition is said to be complete, including both wireless and an airplane as well as automobiles. The organization appears to be an adventure in co-operative working, and the outcome will be looked to with interest. It is evidence of increased interest in gold mining and proves that the love of adventure needs only the lure of gold to kindle it into action.

Afterthought Mine Sold

The Afterthought mine has been sold for $100,000, which sum is to be paid to the bondholders who foreclosed the property. The deed transferring the property will not be forthcoming for a year, as the property is redeemable at any time within twelve months by satisfying the mortgage held by the bondholders. In the meantime the property will be in the charge of Robert Milliken, the receiver. There is a bare possibility that some efforts to reopen the mine may be made within the year.

At the Victory mine, on the South Fork of Russian Creek, Siskiyou County, sufficient ore has been developed to warrant additional development. Mine buildings and flumes for water-power are being constructed. The mine is three miles from the Salmon River highway. John Nenfroney is superintendent. Machinery and supplies are hauled in by motor truck.

The Reid mine, in Old Diggings, Shasta County, is being unwatered by means of an air lift. It is estimated that two months will be required for unwatering. Forty men are employed at the Mammoth copper mine, near Kennett; ten men are employed at the Balaklala mine, and a crew of men is employed at Iron Mountain. Fifty-three mining claims have been filed at Reading, principally upon claims taken up in the Whiskytown and Shasta districts.

NEW MEXICO

Chino Applies for Capital Stock Increase

The Chino Copper Co. has filed with the State Corporation Commission certificates of amendment, increasing the capital stock of its corporations doing business in New Mexico, as follows:

Chino Copper Co., increasing capital stock from $4,500,000 to $5,000,000. Gibson Stores Co., increasing capital stock from $100,000 to $200,000; Santa Rita Store Co., increasing capital stock from $20,000 to $400,000.

THE MARKET REPORT

Daily Prices of Metals

July	Copper, N. Y. net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
12	14.50	38.25	38.75	6.025	5.70@5.85	6.15@6.25
13	14.50	37.75	38.25	6.025	5.80@5.85	6.15@6.20
14	14.50	37.625	38.125	6.025	5.80@5.85	6.15@6.20
16	14.375@14.50	37.25	37.875	6.025	5.80@5.90	6.10@6.15
17	14.375@14.50	37.375	37.875	6.05	5.85@5.90	6.10@6.15
18	14.25@14.375	37.50	38.125	6.075	5.95	6.10
Av.	14.448	37.625	38.167	6.037	5.850	6.150

*These prices correspond to the following quotations for copper delivered: July 12th, 13th, and 14th, 14.75c.; 16th and 17th, 14.625@14.75c.; 18th, 14.50@14.625c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. The quotations are for prompt deliveries. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

July	Copper Standard Spot	Copper Standard 3M	Copper Electrolytic	Tin Spot	Tin 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
12	66	66¾	73	183	184	24⅝	24	29	29½
13	65½	66¼	73	180¾	182	24¼	23¾	28¾	29
16	64⅞	65⅝	72½	178⅞	180⅛	24	23½	28⅝	28⅝
17	64⅝	65⅜	72½	177¼	178¾	24	23½	28⅞	29
18	65	65¾	72½	178⅜	179⅛	24	23½	29⅛	29¼

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

July	Sterling Exchange "Checks"	Silver New York	Silver London	Gold London	July	Sterling Exchange "Checks"	Silver New York	Silver London	Gold London
12	4.58¼	63	30⅞	89/10	16	4.59⅜	62⅞	30¾	89/5
13	4.58½	62¾	30 11/16	89/9	17	4.59	63	30⅞	89/10
14	4.60¼	63¼	30⅞	....	18	4.58¾	63	30⅞	89/8

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

New York, July 18, 1923

Business in the metal markets has not been active during the last week, but this is not an unexpected condition at this time of the year. On the whole, sales were better than last week or the week before, and the selling interests generally are cheerful and optimistic.

Copper

On Thursday, Friday, and Saturday inquiries were quite numerous, and sales of fair volume were made, almost all at the 14.75c. delivered level, which was the generally quoted price by all producers. Over the week-end, however, the London price tapered off 10s., and this must have had a bad effect on consumers on this side, for the market has been only a nominal one for the last three days. Most of the producers are continuing to quote 14.75c., delivered, but are doing little or no business at that price. Others who shaded quotations to 14⅝c. yesterday, and 14.50c. today, have found no buyers interested, even at those levels. Probably exporters could not obtain copper for much less than 14.50c. f.a.s. today, and traders might also have trouble in getting copper at 14.50c. delivered, but this price has been quoted to several of the large consumers.

There can be no doubt that producers are surprised that buying of substantial tonnages of copper could have been deferred so long, but they are not yet much alarmed about it; they feel that consumers are allowing their stocks to run to the lowest possible point and that September requirements remain to be ordered. Statistically copper is in excellent position, and as the producers seem financially able to carry what copper they have on hand for a few weeks longer, no panic to market copper at any price that it will bring is expected. The metal is going well into consumption, most rolling and brass mills operating at as close to capacity as labor supplies will allow.

During the week, producers have been encouraged by increased export business, though the total volume cannot yet be called large. Both Germany and the Orient have entered the market again, and further supplies have been purchased for Scandinavian consumption.

Prices for forward deliveries are the same as are asked for spot and prompt. Most of the orders that have been booked are for August-September delivery. No great demand for prompt delivery has been in evidence.

Lead

The official price of the American Smelting & Refining Co. continues at 6c., New York.

At the lower levels set last week, consumption has been stimulated considerably, and producers report an active week, particularly for deliveries from the Middle Western smelters and refineries. Large consumers and regular customers of the principal producers have been able to buy lead all week at 6c., New York, but the metal has certainly not been pressed on the market at that level, and substantial tonnages have been sold to both dealers and consumers at 6.10 and 6.15c., and today, 6.25c. has been obtained. Much of the inactivity of the last few weeks seems to have been due to a feeling that a decline in price was imminent, and now that the price seems to be in no immediate danger of going lower, quite a bit of postponed business has come into the market. The amount of metal needed by consumers is certainly not as great as it was a few months ago, but production has probably also decreased an equivalent amount, as practically all of the Mexican production has gone abroad and United States production is not what it was. The fire at the Hecla mine will take 2,000 tons a month off the market.

A shortage of lead seems to be in

evidence in the West, where sales have been sufficiently great to absorb all of the low-priced offerings and bring the price almost equal to that in New York. Chicago prices have been substantially the same as those at St. Louis, though 2½ points premium has been obtained in some instances.

Zinc

Although operators in the Joplin-Miami zinc district made a drastic attempt to better their position by curtailing production, their effort affected the market only slightly. Prices rose as high as 6.25c. for Prime Western during the week, but today zinc can be readily obtained for 6.10c. Sales have been light. There is an impression in the trade that zinc manufacturers are working with unusually small supplies on hand so as to keep inventories low. The statistics of the American Zinc Institute for June show an increase in stocks of over 4,000 tons. Stock on hand June 1 was 13,019 tons; production, 42,840; shipments, 38,686; stock on hand June 30, 17,173 tons; shipped from plant for export during June, 560 tons. Export trade has decreased greatly since the beginning of the year and is one of the reasons why the market is listless. High-grade metal is being sold for 8@8¼c. per lb. with the usual freight allowance.

Tin

The tin market was quite active yesterday, but it was owing to short covering by traders. There has been no consuming demand worthy of the name all week. The prices quoted for 99 per cent are largely nominal and represent occasional offerings of Chinese tin. English tin cannot be obtained here much under the Straits price and American tin is extinct. Deliveries of Straits in October have been offered at prices varying from those asked for spot to three-eighths of a cent less.

Arrivals of tin, in long tons: July 10th, Straits, 75; 13th, London, 150; Straits, 570; China, 125; 17th, Liverpool, 100; Total so far in July, 2,360.

Silver

The market continues quiet but steady, with no pronounced tendency. China and India both are fair buyers on any decline but there is no inclination to bid up the price.

Mexican Dollars—July 12th, 48; 13th, 47⅞; 14th, 48¼; 16th, 48; 17, 48; 18th, 18th, 48.

Foreign Exchange

On Tuesday, July 17, cable quotations on francs were 5.8575c.; lire, 4.3c.; marks, 235,300 to the dollar; and Canadian dollars, 2¾ per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 26@27c. per lb.; 98 per cent, 25@26c. London, £115, 98 per cent.

Antimony — Chinese and Japanese brands, 6.75@7c. W. C. C. brand, 7.75c. Cookson's "C" grade, 10@10.50c.

Bismuth—$2.55 per lb. London, 10s.

Cadmium—$1 per lb. London, 4s. 9d.

Cobalt—$3 per lb. for spot.

Iridium—$275@$300 per oz.

Nickel—27@32c. per lb. for 99 per cent virgin metal. London, £130 per long ton.

Palladium—$80@$81 per oz.

Platinum—$116 per oz. London, sponge, £23; manufactured, £25.

Quicksilver—$67 per 75-lb. flask. Quiet. San Francisco wires $65.85. London, £10 5s. to £10 7s. 6d.

The prices of **Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Selenium, Tellurium, Thallium,** and **Tungsten** are unchanged from prices given July 7.

Metallic Ores

Chrome, Iron Ore, Magnetite, Manganese, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, and **Zircon Ore** are unchanged from the quotations published July 7.

Zinc and Lead Ore Markets

Joplin, Mo., July 14—Zinc blende, per ton, high, $38.15; basis 60 per cent zinc, premium, $38.50@$39; Prime Western, $37.50@$38; fines and slimes, $35@$33.50; average settling price, all blende, $35.06.

Lead, high, $86.35; basis 80 per cent lead, $80@$60; average settling price, all lead ore, $77.30 per ton.

Shipments for the week: Blende, 7,273; lead, 997 tons. Value, all ores the week, $332,060.

Estimating the recent normal output at 12,000 tons, the output of 9,590 tons this week indicates a restriction of one-fifth in tonnage. The information is handed out that a five-day week is to be almost generally observed for an indefinite period, in order to hold the production around 10,000 tons per week, a continuous restriction of one-sixth the estimated normal output. Prices this week were forced upward on zinc blende because some buyers had to have ore and none was for sale under $37.50 to $38 basis.

Platteville, Wis., July 14.—Blende, basis 60 per cent zinc, $40 per ton. Lead, basis 80 per cent lead, $70 per ton. Shipments for the week: Blende, 299 tons; lead, 40 tons. Shipments for the year: Blende, 18,366; lead, 460 tons. Shipments for the week to separating plants: 1,213 tons blende.

Non-Metallic Minerals

Fluorspar—Washed gravel, plus 85 per cent CaF_2, minus 5 per cent SiO_2, $23.50 per ton, Illinois; acid lump, $42 per ton. Market quiet. For other quotations, see July 7 issue.

Talc—In New York, double air-floated, $14.75 per ton. Market good.

In California, 200 mesh, "Sierra Snow," $18 per ton, bags extra. "Sierra Cloud," air floated, $25 per ton. Market fair.

Other talc quotations in July 7 issue.

Asbestos, Barytes, Bauxite, Borax, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fuller's Earth, Graphite, Gypsum, Limestone, Magnesite, Manjak, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, Sulphur, and **Tripoli** are unchanged from the July 7 prices.

Mineral Products

Arsenious Oxide (white arsenic)—10@11c. per lb., delivered over the balance of the year.

Copper Sulphate—5.40@5.45c. for large crystals, domestic product.

Sodium Nitrate—$2.45 per 100 lb., ex-vessel, Atlantic ports.

Potassium Sulphate and **Sodium Sulphate** are unchanged from quotations of July 7.

Ferro-Alloys

Ferromanganese—Domestic and imported, $117.50 per long ton. Spiegeleisen unchanged from July 7 prices.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and **Ferrovanadium** are unchanged from the prices published July 7.

Metal Products

Rolled Copper—Sheets, 23.75c., base; wire, 17.50c.

Lead Sheets, Nickel Silver, Yellow Metal, and **Zinc Sheets** are unchanged from the prices given in the July 7 issue.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick and **Zirkite** are unchanged from the July 7 prices.

The Iron Trade

Pittsburgh, July 17, 1923

Pressure for deliveries of steel products is much lighter than a few weeks ago. Most steel buyers have more than one source of supply, and just now each mill is endeavoring to ship all the steel the customer will take. As to cancellations and postponements, it is claimed there are practically none. Theoretically the Steel Corporation's unfilled obligations represent five months of operation at 90 per cent, but they are only one-fourth greater than those of July 1, 1921, when the corporation had the lightest percentage operation in its long history.

Finished-steel prices are firm, except that hoops, bands, and hot-rolled strips have declined slightly. Billets and sheet bars are quotable at $42.50, but could hardly be sold.

Pig Iron.—Bessemer and foundry are off a dollar, the market now being easy at $26.50 for bessemer, $25 for basic, and $25.50 for foundry, f.o.b. Valley furnaces. Demand is extremely light.

Connellsville Coke.—Furnace, $4.75@$5 for spot and contract; foundry, $5.50@$6 for spot.

Statistics of the Copper Industry in the United States in 1921 and 1922

Final statistics of the production of copper in the United States in 1921 and 1922 are given by the Department of the Interior in the following statement, compiled by H. A. C. Jenison, of the Geological Survey.

Summary of Features of the Copper Industry in the United States in 1921 and 1922

	1921	1922
Production of copper:		
Smelter output, lb.	505,586,098	950,285,947
Mine production, lb.	466,190,853	(a)
Refinery production of new copper		
Electrolytic, lb.	506,532,984	766,944,836
Lake, lb.	100,918,001	122,545,126
Casting and pig, lb.	1,963,271	15,180,723
Total domestic, lb.	609,414,256	904,670,685
Total domestic and foreign, lb.	1,020,027,096	1,358,659,101
Total new and old copper, lb.	1,455,000,000	(a)
Ore produced		
Copper ore, short tons	13,396,382	(a)
Average yield of copper, per cent.	1.70	(a)
Other ore yielding copper, short tons	14,248	(a)
Average price per pound, cents	12.9	13.5
Imports (unmanufactured), lb.	350,472,611	541,013,220
Exports of metallic copper (b), lb.	628,415,714	742,755,957
Withdrawn from total supply on domestic account		
Total new copper, lb.	610,988,744	896,633,833
Total new and old copper, lb.	1,046,000,000	(a)
Stocks of refined copper (c), lb	459,000,000	216,000,000
Stocks of blister and materials in solution (c), lb.	283,000,000	361,000,000
Value of production in the United States	$65,221,000	$128,289,000

(a) Figures not yet available. (b) Total exports of copper, exclusive of ore, concentrates and composition metal. (c) At the end of the year.

Smelter Production

The smelter production of primary copper in the United States during 1922 is shown in the preceding table. The average price of 1,913,000,000 lb. of copper delivered in 1922, as reported to the Geological Survey by selling agencies, was 13.4665c. a pound.

In the following table the production is apportioned to the states in which the copper was mined. The figures represent the content of fine copper in the blister produced, the smelter output of ingot, and anode copper from Michigan.

Copper Produced in the United States From Domestic Ores, 1921-1922—Smelter Output

(In Pounds Fine)

State	1921	1922
Alaska	76,808,114	59,900,579
Arizona	155,165,656	428,200,634
California	15,906,883	20,440,430
Colorado	6,592,598	3,635,916
Georgia	.....	8,147
Idaho	1,971,623	3,504,944
Maine	3	.....
Michigan	100,918,001	122,545,126
Missouri	137,591	1,070,259
Montana	49,471,206	165,341,414
Nevada	15,129,116	20,398,611
New Mexico	18,076,909	29,127,329
Oregon	274,934	925,954
Pennsylvania	.....	888,721
Tennessee	15,084,294	14,226,232
Texas	587	3,889
Utah	45,831,959	79,665,563
Washington	598,658	369,133
Wyoming	9,830	.....
Undistributed	3,608,136	33,066
Totals	505,586,098	950,285,947

Refined Copper

The total production of new refined copper in 1922 was 1,359,000,000 lb., an increase of 339,000,000 lb. over that in 1921.

Primary and Secondary Copper Produced by Regular Refining Plants and Imported, 1921-1922

In Pounds

	1921	1922
Primary:		
Domestic (a)		
Electrolytic	506,532,984	766,944,836
Lake	100,918,001	122,545,126
Casting	1,740,393	15,180,723
Pig and best select	228,878	.....
	609,414,256	904,670,685
Foreign (a)		
Electrolytic	(b) 405,337,490	(b) 448,784,819
Casting and best select	5,275,350	5,203,597
	1,020,027,096	1,358,659,101
Secondary		
Electrolytic	82,017,382	100,792,685
Casting	24,467,951	45,217,857
	106,485,333	146,010,542
Total output	1,126,512,429	1,504,669,643

(a) The separation of refined copper into metal of domestic and foreign origin is only approximate, as an accurate separation is not possible.
(b) Includes refined copper imported.

The reports from plants that treat secondary material exclusively are incomplete at this date. In addition to their output of metallic copper the regular refining companies produced bluestone (hydrous copper sulphate) having a copper content of 8,508,000 lb.

Stocks

Returns from all producing companies show that their stocks of electrolytic, Lake, casting, and pig copper on hand and in process of refining on Jan. 1 were as follows:

Stocks of Copper Jan. 1, 1921, 1922, and 1923

In Pounds

Year	Refined Copper	Blister and Material in Process of Refining
1921	659,000,000	465,000,000
1922	459,000,000	283,000,000
1923	216,000,000	361,000,000

The second column above does not include copper in stock at foreign smelters or in transit from foreign smelters to refineries in the United States.

Consumption

The new refined copper withdrawn from the total year's supply on domestic account in the United States in 1922 and the method employed in determining it are shown in the following table, which does not include stocks of copper held by consumers.

New Refined Copper Withdrawn from Total Year's Supply on Domestic Account(a), 1921-1922

In Pounds

	1921	1922
Total supply of new copper	1,020,027,096	1,358,659,101
Stock at beginning of year	659,000,000	459,000,000
Total available supply	1,679,027,096	1,817,659,101
Copper exported (b)	609,038,352	705,025,268
Stock at end of the year	459,000,000	216,000,000
	1,068,038,352	921,025,268
Withdrawn on domestic account	610,988,744	896,633,833

(a) Formerly called "Apparent domestic consumption."
(b) Includes unrefined black blister and converter copper (bars, pigs, or other forms) and refined in ingots, bars, rods, or other forms.

Copper Imported Into the United States in 1922

In Pounds

Country	Ore (Copper Content)	Concentrates (Copper Content)	Matte and Regulus (Copper Content)	Unrefined Black Copper and Copper in Bars, Pigs, or Other Forms	Refined in Bars, Plates, Rods, or Other Forms	Old and Clippings for Remanufacture	Composition Metal, Copper Chief Value
United Kingdom	2,396,043	1,737,707	119,575	23,241,088	2,739,701	11,556,767	719,034
France	168,591	.....	394,277	532,003	3,145,752	4,704,910	.....
Germany	1,114,096	5,980	1,591,619	.....	708,514	277,153	175,662
Spain	7,001,731	.....	70,000	13,916,628	.....	.....	.....
Canada	2,567,149	696,296	283,703	46,211,714	7,532	3,522,162	2,810
Mexico	675,196	11,488,503	3,020,642	46,015,417	47,326	7,508	.....
Cuba	9,220,800	16,056,822	.....	.....	.....	683,393	9,111
Bolivia	436,153	643,907	345	884,622	20,312	18,745	31
Chile	44,041,453	2,073,710	142,261	44,215,265	96,433,739	103,784	.....
Peru	1,013,165	104,646	500,340	81,853,488	.....	.....	.....
Venezuela	901,421	.....	1,236,482	.....	.....	7,974	.....
Australia	24,408	.....	.....	1,850	.....	.....	.....
British South Africa	15,700	24,584	.....	.....	.....	30,899	.....
Portuguese Africa	.....	27,494	.....	44,398,268	.....	.....	.....
Other countries	1,627,220	48,022	1,368,795	1,308,885	40,266	428,120	203,951
Totals	71,203,126	32,907,671	8,728,039	302,579,228	103,143,142	21,341,415	1,110,599

Copper Exported From the United States, 1921-1922

In Pounds

	1921	1922
Ore (copper content)	299,150	62,458
Concentrates (copper content)	60,970	
Unrefined black blister and converter copper (bars, pigs, and other forms)	150,313	169,733
Refined in ingots, bars, rods, or other forms	596,117,247	652,666,939
Rods	(a) 12,770,792	52,188,596
Composition metal, copper chief value	28,916	221,473
Old and scrap	615,946	2,800,862
Pipes and tubes	2,248,503	1,822,580
Plates and sheets	5,105,916	6,748,454
Wire	11,406,997	11,600,480
Insulated wire and cable	(b)	8,575,745
Other manufactures of copper	(b)	6,182,568
	628,804,750	743,039,888

(a) Figures cover period beginning July 1, 1921. (b) Figures not available prior to 1922.

The figures here given are obtained from smelters and refiners and represent the metal actually recovered, in terms of blister and refined copper, from materials treated in 1922. These figures may not exactly correspond with those showing the copper mined during the year, though the variation should not be great. The smelter production and the mine production represent different steps in the production of copper and should not be confused.

Transvaal Gold Output Practically Unchanged

The gold production of Transvaal mines continues normal, the figure for June being 755,309 oz. The record for the last three years follows:

Transvaal Gold Production, 1920-1923

In Fine Ounces

	1920	1921	1922	1923
Jan.	670,503	651,593		764,469
Feb.	625,330	558,137	639,728	704,970
March	707,036	671,123		761,586
April	686,979	681,382	511,338	743,651
May	699,041	687,776	629,786	786,564
June	715,957	678,490	675,697	755,309
July	736,099	689,555	730,635	.....
Aug.	702,083	711,526	752,490	.....
Sept.	682,173	691,026	747,089	.....
Oct.	662,472	707,825	778,159	.....
Nov.	633,737	704,236	764,476	.....
Dec.	632,215	681,847	790,712	.....
Totals	8,153,625	8,114,516	7,020,111	4,516,549

The total for 1917 was 9,018,084 oz.; for 1918, 8,418,292 oz.; and for 1919, 8,330,091 oz.

Imports and Exports of Metals and Ores in May

Imports and exports of some of the more important ores and metals during May, 1923, with revised comparative figures for May, 1922, compiled from the returns to the U. S. Department of Commerce, were as follows:

Imports

In pounds unless otherwise stated

	May, 1922	May, 1923
Antimony		
Ore	.....	351,466
Metal, matte and regulus	1,057,596	2,488,160
Copper		
Ore	4,739,646	9,804,047
Concentrates	6,807	3,188,400
Regulus, coarse metal and cement copper	49,065	.....
Total	4,795,518	12,992,447
Imported from:		
Spain	261,340	701,120
Canada	75,833	1,736,128
Mexico	75,340	3,192,924
Chile	4,227,714	6,977,746
Peru	10,520	47,432
Venezuela	.....	66
Other countries	1,144,771	337,031
Unrefined black, blister and conveter copper in pigs and bars	13,333,863	29,961,531
Imported from:		
Spain	2,282,154	.....
United Kingdom	.....	271
Canada	268,000	3,075,165
Mexico	488,038	881,442
Chile	219,648	9,337,152
Peru	6,081,287	5,752,437
Portuguese Africa	3,632,866	10,133,999
Other countries	361,870	781,065
Refined copper	8,773,518	34,884,735
Old and clippings for remanufacture	429,935	610,700
Composition metal, copper chief value	112,115	2,640,456
Copper manufactures	.....	14,759
Brass		
Old and clippings for remanufacture	17,446,801	7,969,744
Manufactures of brass	.....	60,035
Lead		
Ore and matte	1,250,028	335,480
Bullion or base bullion	8,216,290	9,796,922
Pigs, bars, other forms and old	1,127,419	7,656,622
Manufactures of lead (except type metal)	.....	10,949
Manganese ore, long tons	.....	11,191
Pyrites, long tons	5,323	25,186
Tin		
Tin ore	1,604	124
Tin in bars, blocks and pigs	8,489,881	11,272,037
Imported from:		
United Kingdom	1,485,458	896,525
British Straits Settlements	6,332,642	9,475,399
China	11,200	.....
Dutch East Indies	626,985	218,655
Hongkong	33,596	483,162
Australia	.....	11,200
Other countries	.....	187,096
Tungsten ore, long tons	80	.....
Zinc ore (dutiable)	11,279	1,122,254
Zinc in blocks and pigs, etc. (dutiable)	32,861	1,314
Zinc dust (dutiable)	.....	7,713

Exports of Copper, Lead and Zinc

In pounds

	May, 1922	May, 1923
Copper		
Ores, concentrates, matte, and regulus (copper content)	207	638
Copper and manufactures of (total)	63,978,926	60,577,721
Refined, in ingots, bars, etc.	58,085,033	51,342,028
Exported to:		
Belgium	2,113,452	3,292,282
France	10,889,698	14,339,682
Germany	20,349,878	13,442,400
Italy	3,598,061	2,897,694
Netherlands	1,815,775	369,754
Spain	513,025	451,956
Sweden	2,691,185	1,254,302
United Kingdom	3,709,788	10,290,774
Canada	16,420	1,381,892
China	8,195,391	2,396,800
Japan	1,970,995	671,862
Other countries	2,221,365	552,627
Old and scrap	246,150	286,941
Composition metal, copper chief value	25,125	3,377
Pipes and tubes	139,155	245,526
Plates and sheets	486,720	170,143
Wire except insulated	884,774	438,061
Insulated wire and cable	762,085	995,059
Lead		
Pigs, bars, etc.:		
From domestic ore	1,274,881	261,785
From foreign ore	2,243,122	1,008,393
Exported to:		
France	1,118,917	.....
Germany	672,174	.....
Netherlands	.....	224,064
United Kingdom	672,097	493,254
Argentina	571,213	280,037
Brazil	224,028	134,499
Other countries	259,574	138,324
Other lead manufactures	477,510	445,596
Zinc		
Dross	2,200,208	757,883
Spelter:		
From domestic ore	11,018,309	1,663,545
From foreign ore	560,000	225,009
Total zinc, slabs, blocks, etc.	11,578,309	1,888,554
Exported to:		
Belgium	448,404	224,033
France	1,747,253	627,206
United Kingdom	394,908	884,260
Canada	226,050	137,517
Japan	8,062,126	.....
Other countries	699,568	15,538
In sheets, strips, etc.	489,352	426,256
Other zinc manufactures	67,216	58,888

German Metal Buying More Active

SPECIAL FOREIGN CORRESPONDENCE

The accelerated debasement of the mark exchange has once again favored export business, and inquiries for metals are buoyant. Manufacturers now invariably order metallic materials abroad the moment they receive their own orders, by means of part payment from their customers. Despite the Ruhr entanglement, Germany still consumes around 6,000 metric tons of copper a month, compared with a monthly average of 10,000 metric tons in 1922. It must be noted that, on the other hand, the influx of old metal from Italy, Austria, and, in a lesser degree, from Sweden has become extremely negligible. The amount of rolling-stock orders from Soviet authorities has been reduced, in Sweden, to very small proportions for the time being, so that that country has not much of metallic residues to spare.

German refineries are still well employed in the making of "Raffinade" (standard copper), but they are turning out only 75 per cent of the 1922 average quantity. The same is true of cathodes. American cathodes do not find as ready an outlet as before, notwithstanding the fact that

they are more in favor here than the German make. The present relative cheapness of the red metal is only a small factor so far as home consumption is concerned. The spending of foreign money for unnecessary imports is being regarded as an offense against the ruling governmental prescriptions. As a matter of fact it is exceedingly difficult to secure foreign bills even for so-called legal purposes—i.e., execution of export orders. It is therefore observable that people draw on their reserves and replenish them as soon as they dispose of the funds.

By maintaining the balance in stock there is today a last reserve of about 10,000 metric tons of copper, 12,000 metric tons of zinc, 15,000 metric tons of lead, 800 metric tons of tin, and 2,000 metric tons of aluminum in the country, whereas the visible supply of antimony and of rare metals is not worth mentioning. The zinc production amounts now to about 100,000 metric tons a year, Upper Silesia producing 70,000 metric tons. Lead is being produced at the rate of nearly 60,000 metric tons, but the actual demand for this metal is much greater. Because of the closing of the western dyes mills, the mills in non-occupied Germany, especially in Thuringia and Silesia, are anxious to fill up the gap left, so that the consumption of zinc and lead is fairly good at the moment.

The Mansfeld Copper Co., of Eisleben, records a production of 15,294 metric tons of copper in the year 1922; that is, 64.3 kg. per workingman against 98 kg. in 1914. Mining operations of the company are being well developed.

Davis-Daly Copper Co.

Copper; Butte, Mont.

A report of the operations of the Davis-Daly Copper Co. for the first three months of 1922 states that earnings have been gratifying in view of the lower grade of ore extracted and the restricted territory operated as the result of the injunction.

Total development for the quarter, including Hibernia, was 4,795 ft., comprising 1,442 ft. of crosscuts, 2,460 ft. of drifts, and 893 ft. of raises.

Tonnage for the three months from the Colorado mine amounted to 49,300, producing 3,228,542 lb. of copper and 181,838 oz. of silver. Ore hoisted from the Hibernia mine amounted to 14,004 tons, producing 187,857 oz. of silver. The assays averaged 3.50 per cent copper and 3.93 oz. of silver to the ton.

Operating receipts and disbursements follow:

Receipts

	Ore Returns	Miscellaneous Revenue
January	$184,044.40	$1,160.34
February	123,805.35	555.72
March	163,084.67	3,030.38
Total receipts, $475,680.86	$470,934.42	$4,746.44

Disbursements

	Development	Mining Cost	Equipment	Butte General Expense	Boston Expense
January	$16,857.01	$69,108.32	$1,981.46	$21,915.80	(a) $6,260.54
Feburary	18,435.04	51,431.94	1,982.30	20,180.76	1,822.82
March	24,109.28	67,422.42	2,747.10	14,342.26	2,187.28
	$59,401.33	$187,962.68	$6,710.86	$56,438.82	$10,270.64

Total disbursements, $320,784.33
(a) Including Capital Stock Tax.

Winona Copper Co.

Copper; Winona, Mich.

The annual report of the Winona Copper Co. for 1922 states that encouraging discoveries have been made on the eighth and tenth levels of the King Philip No. 2 shaft. Development is continuing, and it is hoped that an adequate tonnage of commercial ore will be found to make the mine a paying one. The stamp mill could be put in operation whenever there is sufficient ore for it to handle. Sales of timber and stamp sand have been made to provide the money to continue exploration, and also money has been received from the sale of stock. The company had $6,435 of cash in the treasury.

Facts for the Stockholder

XXIII—Isle Royale Copper Co.

THE ISLE ROYALE COPPER CO. was incorporated in New Jersey, in March, 1899, as a consolidation of the Isle Royale Consolidated Mining Co. and the Miners' Copper Co. It owns 18,836 of the 100,000 shares of the Lake Milling, Smelting & Refining Co., which acquired the Tamarack Mining Co.'s stamp mill and boiler plant, and an interest in the Mutual Water, Light & Power Co. The property includes 3,520 acres of land in Houghton County, Mich., covering parallel amygdaloidal beds known as the Isle Royale and the Portage, and including the Isle Royale, Grand Portage and Huron mines, the Dodge and Frue properties, mineral rights in the Montezuma tract, and several undeveloped properties. Its land covers about 2½ miles of the strike of the copper-bearing beds. The amygdaloidal beds, which have an average dip of about 56 deg., are opened by numerous shafts ranging in depth from 800 to 3,650 ft. Underground development work has been advanced in recent years at the rate of 10,000 to 19,000 linear feet per annum. Extensive diamond drilling has been done.

Although the ore is low grade, favorable development results and improvement in mining methods have raised its quality in recent years as follows: 13.4 lb. copper per ton of ore in 1916, 14.6 lb. in 1917, 15.9 in 1918, 17.95 in 1919, 17.94 in 1920, 21.37 in 1921, 26.92 in 1922.

Surface equipment includes hoisting plants at the various operating shafts, together with power plants, machine shops, and other auxiliary buildings, and a stamp mill on Portage Lake at the mouth of the Pilgrim River. The mill has three heads, two compound heads having a daily capacity of 750 tons each, and the single head with a capacity of 500 tons. Company owns about 150 dwellings. It owns also the Isle Royale R.R., having about five miles of track, connecting with the Duluth, South Shore & Atlantic Ry.

Production in recent years has been about as follows, in millions of pounds of copper: 7.5 in 1911, 8.2 in 1912, 4.1 in 1913, 6.6 in 1914, 9.3 in 1915, 12.4 in 1916, 13.5 in 1917, 15.4 in 1918, 13.0 in 1919, 10.6 in 1920, 2.3 in three months of 1921, and 6.6 in nine months in 1922. Operations at the property were suspended April 1, 1921, and resumed April 1, 1922.

Operating costs are estimated as follows: 10.85c. per lb. of copper in 1911, 11.89c. in 1912, 18.45c. in 1913, 12.79c. in 1914, 14.52c. in 1915, 15.32c. in 1916, 15.74c. in 1917, 17c. in 1918, 16.3c. in 1919, 18.59c. in 1920, 17.69c. in 1921, and 14.19c. in 1922.

Capitalization consists of 150,000 shares, par $25, of which 35,000 shares are owned by the Calumet & Hecla Mining Co. Shares are listed on the Boston Stock Exchange. The head office of the company is at 12 Ashburton Place, Boston, the same as that of the Calumet & Hecla. R. L. Agassiz is president, and James MacNaughton is general manager.

The record of earnings is estimated as follows: $1.04 a share in 1911, $2.79 in 1912, a deficit of $0.88 in 1913, earnings $0.16 in 1914, $3.32 in 1915, $9.14 in 1916, $6.09 in 1917, $4.18 in 1918, $1.93 in 1919, deficit $2.32 in 1920, deficit $2.55 in 1921, deficit $1.14 in 1922.

The dividend record is irregular. In 1913, $1 a share was paid; no dividends were paid in 1914 and 1915; in the four following years payments were $3 in 1916, $6 in 1917, $2.50 in 1918, $1 in 1919; none in 1920 and 1921. Dividends were resumed Aug. 31, 1922, with the payment of 50c. a share, and another like payment was made Dec. 22, 1922, and March 15, 1923.

On Dec. 31, 1922, total current assets were $1,414,365, with current liabilities of $169,000, leaving net working capital $1,245,365. Net assets applicable to capital stock were estimated at $49.80 a share.

Price range of the stock during the last ten years has been as follows: High, 43 in 1916; low, 15 in 1920; closing price July 13, 1923, 22.

INVESTIGATOR.

MINING STOCKS

Week Ended July 14, 1923

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	61	56	61	June 23, Q	$1.50
Alaska-Br. Col.	N. Y. Curb	1⅛	1⅛	1⅛		
Allouez	Boston	20	18	19	Mar. '19	1.00
Anaconda	New York	40½	39¼	40⅜	Je. 16, Jy. 23	0.75
Arcadian Consol.	Boston	1⅛	1	1⅛		
Ariz. Com'l	Boston	10¾	10¼	10¾	Oct. '18, Q	0.50
Calaveras	N. Y. Curb			2		
Calumet & Arizona	Boston	49¾	47½	49	June '23,	1.00
Cal. & Hecla (New)	Boston	43	42¼	43	June '23, Q	10.00
Centennial	Boston			8½	Dec. '18, SA	1.00
Cerro de Pasco	New York	40	38⅛	40	Jy. 19, Au. 1	1.00
Chile Copper	New York	25⅞	24⅞	25⅛	Je. 2, Je.30 Q	0.62½
Chino	New York	19	18⅛	19	Sept. '20, Q	0.37½
Con. Coppermines	N. Y. Curb			2⅛		
Copper Range	Boston	31½	29	31½	May '23, Q	1.00
Crystal Copper	Boston Curb	*83	*76	*78		
Davis-Daly	Boston	2¼	2¼	2¼	Mar. '20, Q	0.25
East Butte	Boston	6	5½	6	Dec. '19, A	0.50
First National	Boston Curb	40	35	35	Feb. '19, SA	0.15
Franklin	Boston	1¼	1	1¼		
Gadsden Copper	Boston Curb	*60	*50	*50		
Granby Consol.	New York	19	17⅛	19	May '19, Q	1.25
Greene-Cananea	New York	18	17⅜	18	Nov. '20, Q	0.50
Hancock	Boston	2⅛	1⅞	1⅞		
Howe Sound	N. Y. Curb	3⅛	3⅛	3¼	Jy. 2, Jy.16	0.05
Inspiration Consol.	New York	29	28	29	Je.14, Jy. 2 Q	0.50
Iron Cap	Boston Curb			4⅝	May 23, K	0.15
Isle Royale	Boston	22½	21½	22	June '23, Q	0.50
Kennecott	New York	34⅜	33⅛	33⅞	Je. 8, Jy. 2 Q	0.75
Keweenaw	Boston	1	*80	*80		
Lake Copper	Boston	2⅛	1⅞	2		
Magma Copper	New York	30	29½	30	Jan. '19, Q	0.50
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛		
Mass Consolidated	Boston	1 1/16	1⅛	1⅛	Nov. '17, Q	1.00
Miami Copper	New York	24½	22⅞	24	Au. 1, Au. 15, Q	0.50
Michigan	Boston	1⅛	1	1⅛		
Mohawk	Boston	43¼	40½	42⅜	June '23, Q	1.00
Mother Lode Coa	New York	8½	8⅜	8½	Je. 8, Je. 30, Q	0.50
Nevada Consol.	New York	12	11⅛	12	Sept. '20, Q	0.25
New Cornelia	Boston	17½	17	17½	May '23, Q	0.25
North Butte	Boston	3¼	3⅛	3⅛	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*74	*60	*74		
Old Dominion	Boston	20	19	20	Dec. '18, Q	1.00
Osceola	Boston	29	28	29	June '23, Q	1.00
Phelps Dodge	Open Mar.	†160	†170	....	Je. 20, Jy. 2 Q	1.00
Quincy	Boston	28	25	28	Mar. '20, Q	1.00
Ray Consolidated	New York	11⅛	11	11¼	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	1⅛	1	1		
St. Mary's Min. Ld.	Boston	35	34	35	Mar. '23, K	3.00
Seneca Copper	New York	7⅜	7⅛	7⅜		
Shannon	Boston	*55	*55	*55	Nov. '17, Q	0.25
Shattuck Arizona	New York			6	Jan. '20, Q	0.25
South Lake	Boston			*12		
Superior & Boston	Boston	1 1/16	1	1		
Tenn. C. & C. cfs.	New York	9¼	9	9¼	Je. 30, Jy. 16, Q	0.25
Tuolumne	Boston			12	May '13,	0.10
United Verde Ex	N. Y. Curb	31	30	31	Jy. 5, Au. 7, Q	1.00
Utah Consol.	Boston	1⅛	1⅛	1⅛	Sept '18,	0.25
Utah Copper	New York	59⅛	57⅛	58⅛	Je. 8, Je. 30, Q	1.00
Utah Metal & T.	Boston	*47	*47	*47	Dec. '17,	0.30
Victoria	Boston			*75		
Winona	Boston	*50	*40	*50		
Wolverine	Boston	7⅛	5⅛	7⅛		
NICKEL-COPPER						
Internat. Nickel	New York	12⅜	12⅛	12⅛	Mar. '19,	0.50
Internat. Nickel pfd.	New York	81	81	81	Jy. 19, Au. 1	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh			3⅜		
National Lead	New York	113	111¾	113	Je.15, Je.30 Q	2.00
National Lead pfd.	New York			107	June '23, Q	1.75
St. Joseph Lead	New York	17⅛	17⅛	17⅛	Se.9,Se.20 Q,X	0.50
ZINC						
Am. Z. L. & S.	New York	8⅛	8⅛	8⅛	May '20,	1.00
Am. Z. L. & S. pfd.	New York			31	Nov. '20, Q	1.50
Butte C. & Z.	New York	6⅜	6	6	Mar. '23,	0.50
Butte & Superior	New York	20⅛	19⅞	20⅛	Je. 15, Je. 30, Q	0.50
Callahan Zn-Ld	New York	6⅛	5⅞	6⅛	Dec. '20, Q	0.50
New Jersey Zn	N. Y. Curb	151	151	151	Jy.31,Au.10 Q	2.00
United Zinc	N. Y. Curb	*75	*41	*41		
Yellow Pine	Los Angeles	*59	*59	*59	June '23, Q	0.03
SILVER						
Alvarado	N. Y. Curb			3⅛		
Batopilas Mining	New York	⅛	⅛	⅛	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*33	*31¼	*31⅓	May '20, K	0.03
Candelaria	N Y. Curb			*8		
Castle-Trethewey	Toronto	*24½	*23⅓	*24		
Coniagas	Toronto	2.80	2.70	2.80	May '21, Q	0.12½
Crown Reserve	Toronto	*59	*57	*57	Jan. '17,	0.05
Hilltop-Nev	N. Y. Curb.	1⅛	1 1/16	1 1/16		
Kerr Lake	N. Y. Curb	2⅜	2⅜	2⅜	Jy. 2, Jy. 16, Q	0.12½
La Rose	Toronto	*30	*29½	*29½	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*20	*18	*18	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	2.50	2.20	2.20	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	5⅛	4⅞	5⅛	Jy. 1, Jy. 20 Q	0.15
Ontario Silver	New York			4½	Jan. '19, Q	0.50
Temiskaming	Toronto	*42	*41	*41	Jan. '20, K	0.04

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	⅜	⅛	⅜		
Alaska Juneau	New York	1⅛	1	1⅛		
Boundary Red M.	N. Y. Curb	*12	*12	*12		
Carson Hill	Boston	6½	5⅛	6½		
Cresson Consol. G.	N. Y. Curb	3⅜	3 3/16	3⅜	Apr. '23 Q	0.10
Dome Mines	New York	35½	34⅛	35½	Je.30, Jy.20 Q	1.00
Golden Cycle	Colo. Springs		1.02½		Dec. '22, Q	0.02
Hollinger Consol.	Toronto	12.45	12.35	12.35	Je.28, Jy.16 M	0.05
Homestake Mining	New York	63	63	63	Je.20, Je.25 M	0.50
Kirkland Lake	Toronto	*33	*32⅛	*32½		
Lake Shore	Toronto	3.40	3.40	3.40	May '23, Q	0.02
McIntyre-Porcupine	New York	17⅛	16½	17	May '23, Q	0.25
Portland	Colo. Springs			*35	Oct. '20, Q	0.01
Teck-Hughes	N. Y. Curb	1 1/16	1⅛	1 1/16		
Tom Reed	Los Angeles	*50	*40	*40	Dec. '19,	0.02
United Eastern	N. Y. Curb	1⅛	1⅛	1⅛	Jy. '28, Q	0.15
Vipond Cons.	Toronto	*61	*59	*59		
Wright-Hargreaves	Toronto	3.30	3.25	3.25	Apr. '23,	0.02½
Yukon Gold	N. Y. Curb	1⅛	1⅛	1⅛	June '18,	0.02½
GOLD AND SILVER						
Boston-Mont. Corp.	N. Y. Curb	*15	*14	*15		
Con. Cortez	N. Y. Curb	*68	*65	*67		
Cons. Virginia	San Francisco	9⅛	9⅛	9⅛		
Continental Mines	N. Y. Curb	5⅛	5	5⅛		
Dolores Esperanza	N. Y. Curb			1¼	Jy. 1, Jy.10 Q	0.05
Jib Consol	N. Y. Curb			*70		
Tonopah Belmont	N. Y. Curb	*78	*74	*74	Apr. '23, Q	0.05
Tonopah Divide	N. Y. Curb	*50	*49	*49	May 23	0.10
Tonopah Extension	N. Y. Curb	1⅛	1⅛	1 1⅛	Je. 9, Jy. 2	0.05
Tonopah Mining	N. Y. Curb	1⅛	1 1/16	1 1/16	Apr. '23, Q	0.07½
Unity Gold	N. Y. Curb	3⅛	3	3⅛		
West End Consol.	N. Y. Curb	*80	*76	*77	Mar. '23, Q	0.05
SILVER-LEAD						
Bingham Mines	Boston			*16½	Sept. 19, Q	0.25
Cardiff M. & M.	Salt Lake	*56	*41½	*56	Dec. '20,	0.15
Chief Consol.	Boston Curb	4⅛	4	4	May '23, Q	0.10
Columbus Rexall	Salt Lake	*50	*44½	*44½	Aug. '22,	0.03
Consol. M. & S.	Montreal	25½	25	25	Oct. '20, Q	0.62½
Erupcion	Boston Curb	2⅛	2	2⅛	Apr. '23, Q	0.125
Federal M. & S.	New York	8	8	8	Jan. '09,	1.50
Federal M. & S. pfd.	New York	38¼	37⅛	37⅞	June '23, Q	1.75
Florence Silver	Spokane			*38	Apr. '19, Q,X	0.01⅛
Hecla Mining	N. Y. Curb	7⅛	6⅛	6⅛	Je. 15 Q	0.50
Iron Blossom Con.	N. Y. Curb	*26	*26	*26	June '23	0.02½
Marsh Mines	N. Y. Curb	*7	*6	*6	June '21, I	0.02
Park City	Salt Lake	3.25	3.25	3.25	Je.15, Jy.2 Q	0.12½
Park Utah	N. Y. Curb	3⅛	3⅛	3⅛	Je.15, Jy.2 Q	0.15
Prince Consol.	Salt Lake	*3⅛	*2	*3⅛	Nov. '17,	0.02½
Silversmith	Spokane			*38	Jy. 2, Jy. 10	0.02
Simon Silver-Lead	N. Y. Curb			*23		
Snowstorm Silver-L.	N. Y. Curb			*43		
Tamarack-Custer	Spokane			1.25	Je.30, K	0.02
Tintic Standard	Salt Lake	3.00	2.90	2.97½	July '23	0.15
Utah-Apex	Boston	3⅛	3⅛	3⅛	June '23, Q,X	0.50
IRON						
Bethlehem Steel	New York	46⅜	43¼	46	Je. 1, Jy. 2 Q	1.25
Char. Iron	Detroit	*87⅛	*87⅛	*87⅛		
Char. Iron pfd.	Detroit	1⅛	1⅛	1⅛		
Colorado Fuel & Iron	New York	28	26⅛	26⅛	May '23, Q	2.00
Col. Fuel & Iron pfd.	New York			102	Feb. '23, Q	2.00
Gt. North'n Iron Ore	New York			25⅛	Apr. '23	1.00
Inland Steel	N. Y. Curb			46½	June '23 Q	0.62½
Mesabi Iron	N. Y. Curb			9		
Replogle Steel	New York	15⅜	13⅛	15⅜		
Republic I. & S.	New York	45½	41⅛	44⅛	May '2!	1.50
Republic I. S. pfd.	New York	89½	87	89⅛	Je.15, Jy.2 Q	1.75
Sloss-Sheffield S. & I.	New York	43	39½	43	Feb. '21	1.50
Sloss-Shef. S.&I. pfd.	New York	78⅜	78	78	Je. 22, Jy. 2 Q	1.75
U. S. Steel	New York	92⅞	89⅛	91	Je.29, Q	1.25
U. S. Steel pfd.	New York	118⅛	118	118	May '23	1.75
Virginia I. C. & C.	New York			52	Je.16, Jy. 2	2.00
Virginia I.C.&C.pfd.	New York			77½	Je.16, Jy. 2	2.50
VANADIUM						
Vanadium Corp.	New York	33⅛	27	33	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	52⅛	52	52	Je.30,Jy.15 Q	1.50
Asbestos Corp. pfd.	Montreal			75	Je.30,Jy.15 Q	1.75
SULPHUR						
Freeport Texas	New York	11	10⅛	11	Nov. '19, Q	1.00
Texas Gulf	New York	57⅛	55⅛	57	June '23, Q	1.50
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3⅛	2⅛	3⅛		
MINING, SMELTING AND REFINING						
Amer. Metal	New York	43	42	42⅛	Je. 1, Q	0.75
Amer. Metal pfd.	New York			107⅛	Je. 1, Q	1.75
Amer. Sm. & Ref.	New York	56	53	56	Jy. 9, Au. 1	1.25
Amer. Sm.& Ref. pfd	New York	95½	95⅛	95⅛	Au.10, Se.1 Q	1.75
U. S. Sm. R. & M.	New York	23½	23	23½	Jan. '21, Q	0.50
U.S. Sm.R.& M. pfd.	New York	41½	41⅛	41½	Jy.6,Jy.14 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

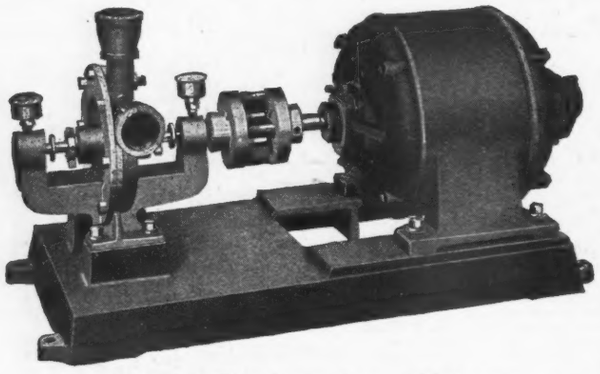
Toronto quotations courtesy Arthur E. Moysey; Spokane, Pohlman Investment Co; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, Colorado Springs Stock Exchange.

NEW MACHINERY AND INVENTIONS

Something New in Pumps

The Westco pump employs an original and distinct principle in its design, it is claimed. It combines the positive action of the plunger pump with the large volume and simplicity of the simplest centrifugal pump and, as claimed by the manufacturers, with none of the disadvantages of either type. It is simple, compact, practical, and economical. Much experimental work was required to develop the original crude idea. The first pumps were built several years ago and put to practical tests of daily operation. Today a line of pumps has been developed to meet pumping requirements of over 60,000 gal. per hour. They are designed to operate at high pressure and have found considerable application in mining.

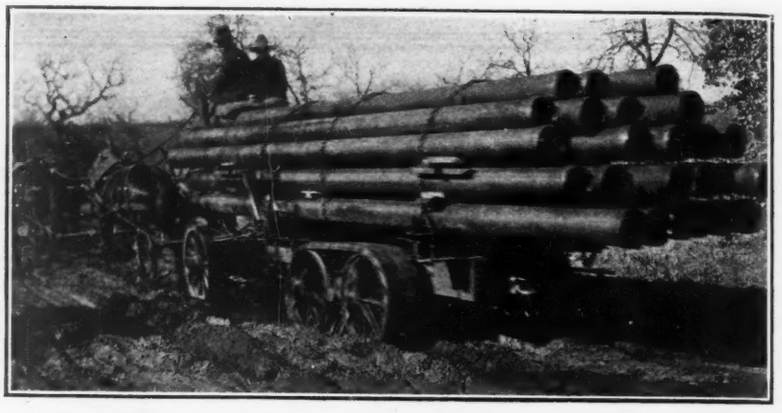
The pump has but one moving part, this being a circular disk or wheel, called the impeller. The water is taken in at the periphery and discharged at the periphery. The design of the impeller is one of the features of the pump, being the result of a great deal of experimental work, and is made with precision. It has the large pumping capacity of the centrifugal pump and the pressure possibilities of the plunger pump.



Pump for handling heavy flow at high pressure

The materials entering into the construction of Westco pumps have been the subject of careful investigation. The pump shafts are of monel metal, being proof against rust and corrosion. Although the standard construction calls for iron bodies and bronze impellers, the pumps are also made of special alloys to handle various solutions and acid mine waters. The acid-proof quality of these pumps makes them particularly adapted to many underground mining conditions. The pumps are ball bearing and direct connected by a flexible coupling.

A catalog entitled "The Westco Idea," which gives complete information on this product, will be sent upon application by the Western Pump Co., Davenport, Iowa.



Hauling pipe over heavy ground made easier by using truss wheels

Truss Wheels for Heavy Loads in Soft Ground

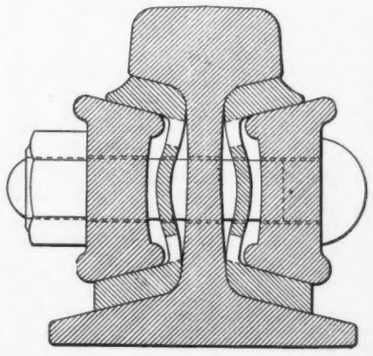
A wheel which is used for carrying heavy loads over soft ground and which is particularly useful in hauling materials for oil pipe lines in territory where the ground is constantly soft is manufactured by the Athey Truss Wheel Co., 17 North La Salle St., Chicago, Ill. Unlike the caterpillar or track-laying type of wheel, the track band in this wheel is a truss, rigid in one direction but free to fold the opposite way. When resting on the ground this truss band forms a sort of steel bridge for the wheels to roll over, and it is so constructed that a band can never run off of the wheels. The band is loose on the wheels, and each shoe or link extends in front of the wheels in working position before the wheels roll on to it, and also picks up at the rear after the wheel has passed off, so that the main pins never rotate under load and only turn when merely the weight of the parts is carried. The two wheels together present a square yard of surface to the ground, and their action on soft mud is that of compression and not of kneading. It is claimed that because of this construction it is possible to transport 10-ton loads on a wagon equipped with these wheels over any soil which will support animals or tractors.

Series Centrifugal Pump

A new style of centrifugal pump, called a "series pump," is now being made by the De Laval Steam Turbine Co., Trenton, N. J. In this pump, double-suction impellers and volute diffusers are used, as in single-stage centrifugal pumps. The connecting passages from stage to stage, however, are included in the pump-case casting, as in the ordinary multistage pump. The advantages claimed are perfect hydraulic axial balance and high efficiency under varying loads, as is characteristic of the single-stage pump. These series pumps are made with two or three stages. Where more than three stages are required, the use of two independent pumps operating in series and mounted on a single base plate is recommended in order to keep down the length of shaft between bearings.

New Rail Joint

In a rail joint made by the American Rail Joint Co., 141 Broadway, New York, the splice bars which form it are in two parts, the outer or channel-shaped parts which engage the fishing surfaces of the rail and a smaller bar which is designed to fit the secondary fishing surfaces on the larger bar. The channel-shaped bar is made with a relatively thin web, which is curved so as to permit of some amount of resilience for the purpose of spreading the two flanges of the bar apart. It is claimed that this is necessary in order to obtain the proper adjustment of the fit against the fishing surfaces of the rail and to take up the wear occurring in these contact surfaces. The smaller bars of the joint are forced together by tightening up bolts, and this action serves to force the channel-shaped bars into a snug fit, not only against the fishing surfaces of the rail but also against a considerable part of the web. This rail splice serves as a guide, which provides a continuous beam action of the rail across the joint and also an efficient slip joint for ready adjustment, for changes in temperature.



Rail joint with splice bars in two parts